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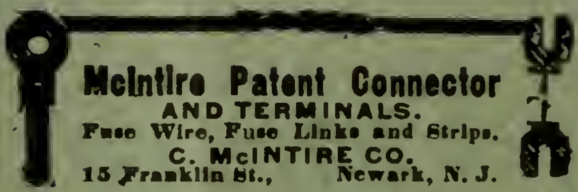

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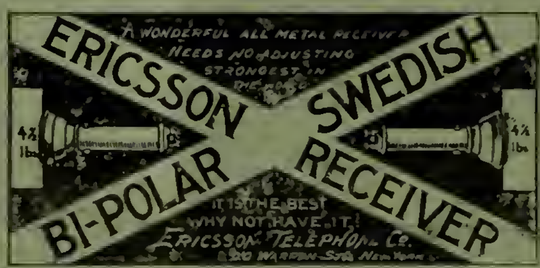

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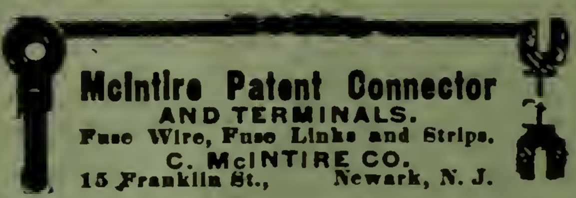

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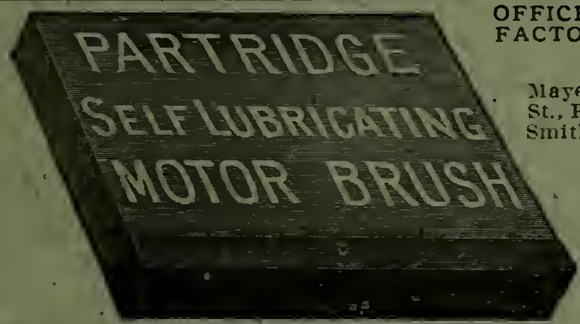

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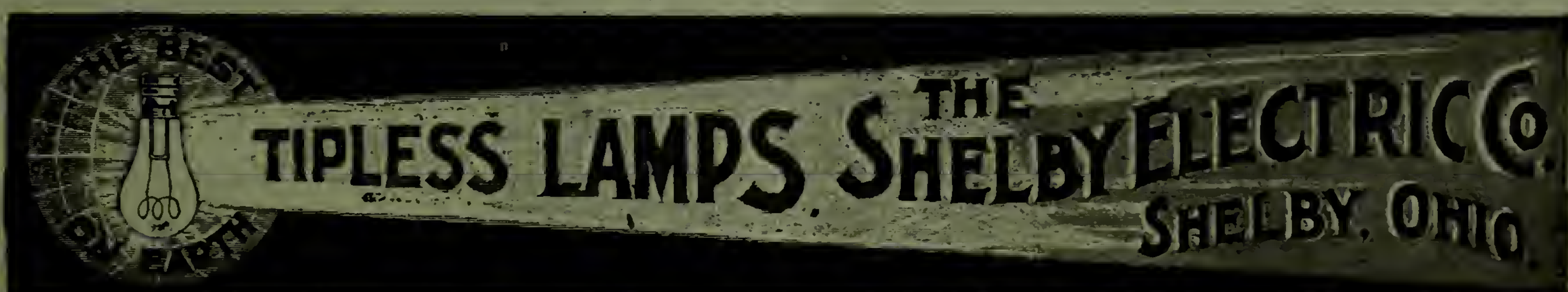

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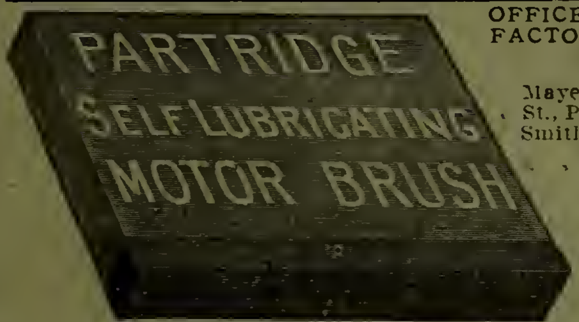

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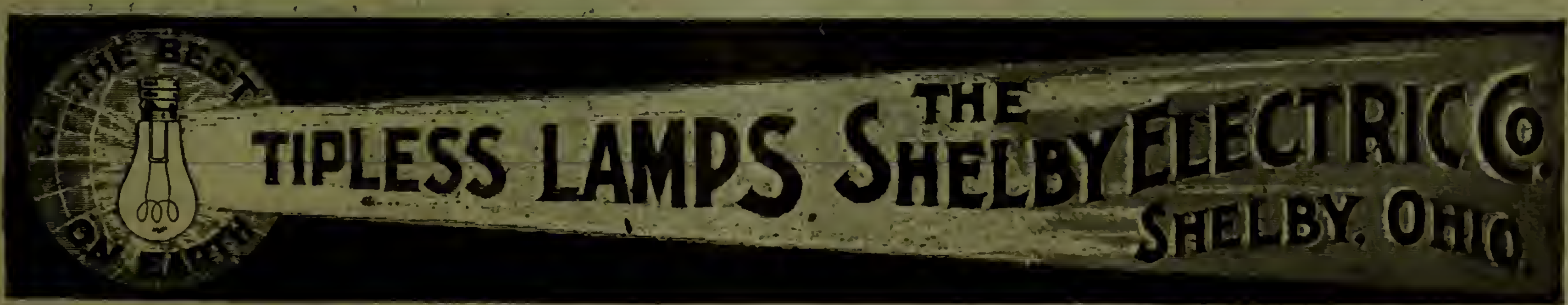

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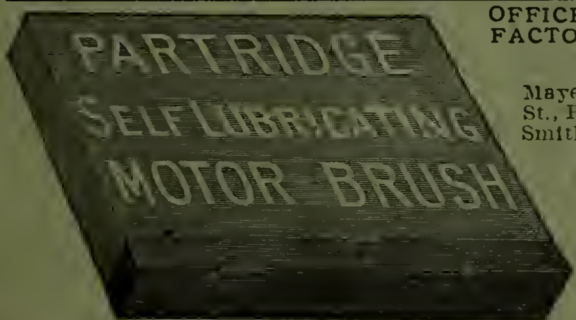

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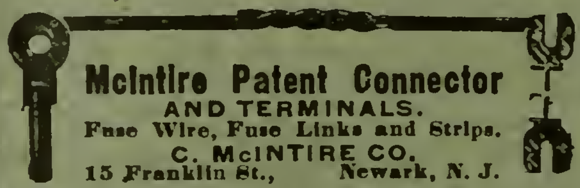

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THE SAFETY THIRD RAIL ELECTRIC SYSTEM.

The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy.

VOL. XXIII.—No. 624. NEW YORK, APRIL 29, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

Classified List of Advertisers page vi., vii.

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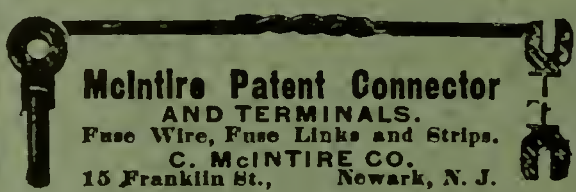

SETTING TYPE BY ELECTRICITY.

The Electrical Age

Established 1883. | An Illustrated Weekly Electrical Journal. | 10 cents per copy.

VOL. XXIII.—No. 625. | NEW YORK, MAY 6, 1899. | Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

Classified List of Advertisers page vi., vii.

During your visit to the Electric Show at Madison Square Garden do not fail to visit THE ELECTRICAL AGE, Newspaper Row, Balcony.

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"THE CHARM OF THE AUTOMOBILE."

The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy.

VOL. XXIII.—No. 626. NEW YORK, MAY 13, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

Classified List of Advertisers page vi, vii.

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A BRUSHLESS DIRECT CURRENT DYNAMO.

N. E. L. A. CONVENTION.

The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy.

VOL. XXIII.—No. 627. NEW YORK, MAY 20, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

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ENGINEERING IN THE LAND OF THE CZAR.

TESLA'S SPEECH BEFORE THE CHICAGO COMMERCIAL CLUB.

The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy.

VOL. XXIII.—No. 628. NEW YORK, MAY 27, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

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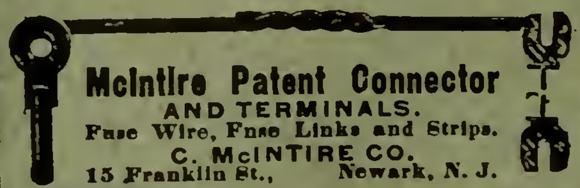

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NATIONAL ELECTRIC LIGHT ASSOCIATION
CONVENTION REPORT NUMBER.

The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL. XXIII.—No. 629. NEW YORK, JUNE 3, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

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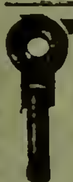

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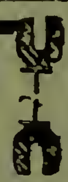

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TALKING ALONG A BEAM OF LIGHT.

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Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL. XXIII.—No. 630. NEW YORK, JUNE 10, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

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The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL. XXIII.—No. 631. NEW YORK, JUNE 17, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.

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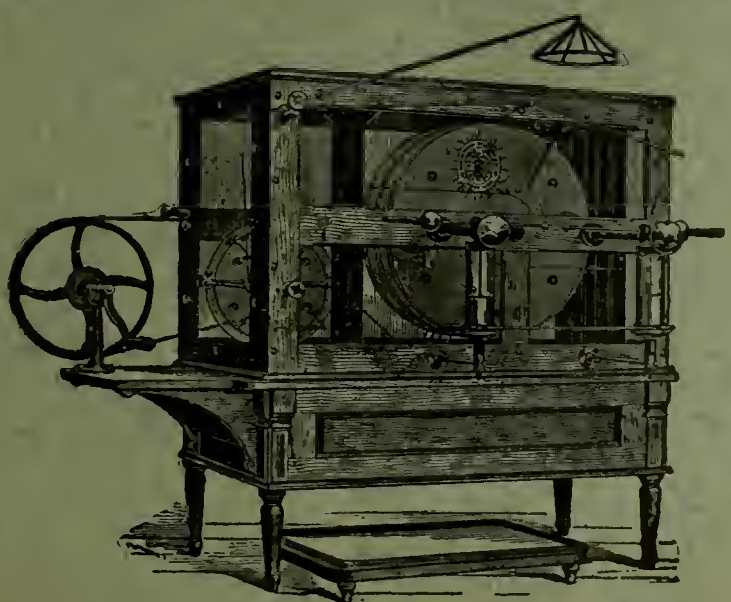
AN ELECTRICAL GYMNASIUM.

The Electrical Age

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL. XXIII.—No. 632. NEW YORK, JUNE 24, 1899. Subscription, $2.50 per year. Foreign Countries, $3.50 per year.



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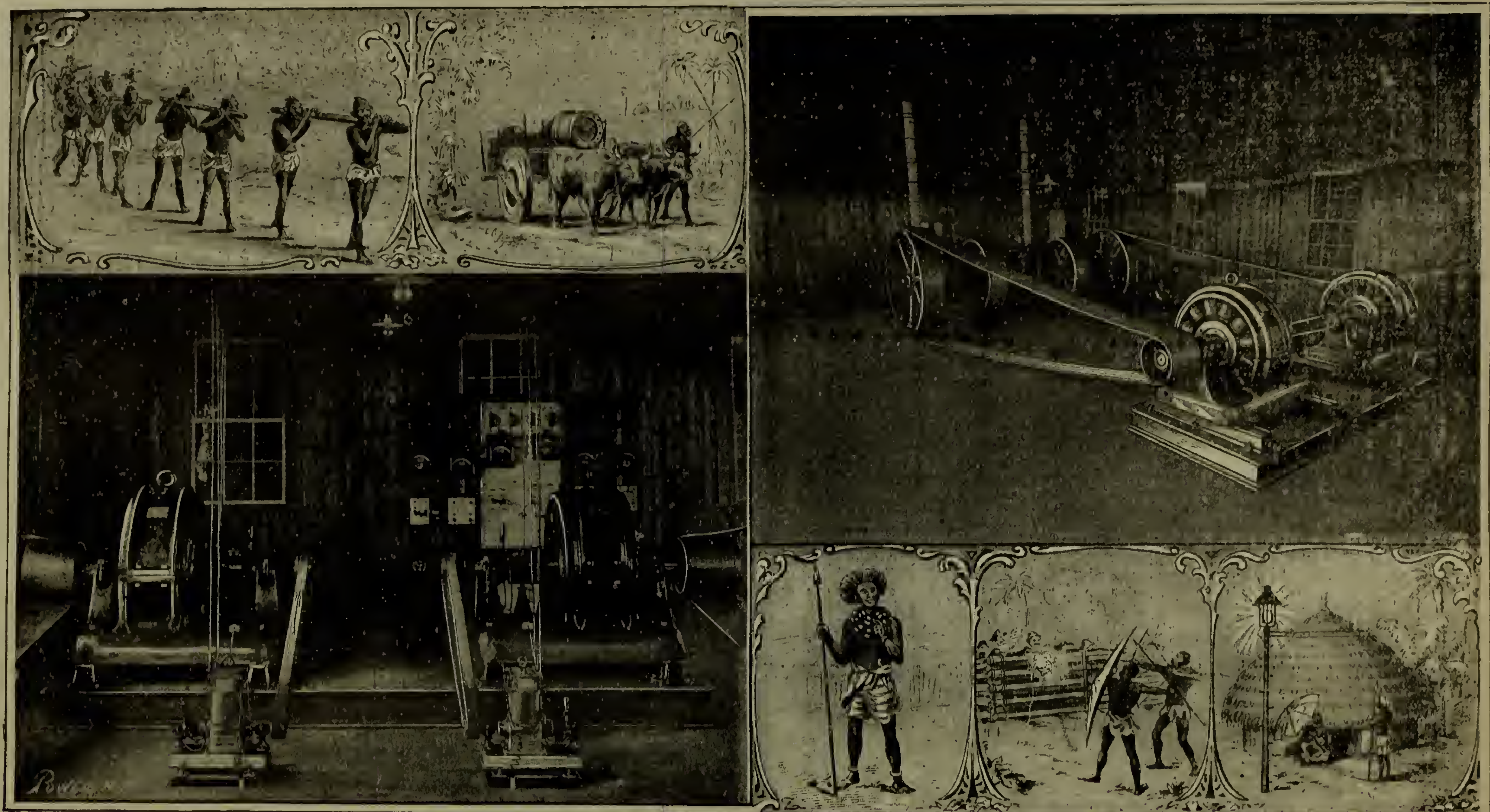
The Electrical Age.

Vol. XXIII—No. 1 NEW YORK, JANUARY 7, 1899 Whole No. 608

ELECTRIC LIGHT AND POWER.



Electric Light "In Darkest Africa."
(Courtesy of "Power.")

ELECTRIC LIGHTS "IN DARKEST AFRICA."

Courtesy of "Power."

We must apologize to the African explorer, Mr. Stanley, for appropriating part of the above heading. While there are still some dark spots in Africa, one of them is now being brought out of the gloom by means of electric lights, receiving their current from electric machines driven by engines, which are in turn supplied with steam by boilers which were built in the United States and shipped to Africa, where they were erected by American engineers.

The plant in question is in the town of Buluwayo, which is situated in a sparsely settled country in the south central part of Africa. Our photographs show views of the engine and generator room taken from each end of the room; as will be noticed the building is built of wood with a flat roof. The plant con-

sists of two 125 horse power Babcock & Wilcox horizontal water tube boilers; two McIntosh & Seymour horizontal, simple, center crank engines of 130 horse power each; two A-90 kilowatt General Electric single phase alternating current dynamos, and two Blake feed pumps. The engines are belted to the dynamos as shown. The current generated is used for both public and private lighting.

Not the least interesting part in connection with the installation of this plant was the difficulties met with in transporting it to its destination. The plant was shipped by steamer from New York to Cape Town, there it was reloaded on the railroad and carried to Mafeking, the nearest rail station, and from thence transported by means of bullock teams over 500 miles, through a sparsely inhabited territory, with no roads to speak of, to Buluwayo.

While this plant was being transported the native uprising in the country where the town is situated and known as the Matabele war broke out. Some of the material was then at Buluwayo, some of it en route on the carts drawn by bullocks, and some of it at Mafeking. About all of the small wire which had been delivered was seized by the Buluwayo authorities and used for connecting subterranean powder mines, buried in the approaches leading to the town. The erecting engineers who went out with the plant from this country were impressed in the military service for the defense of the town, and made to do guard and picket duty. The larger proportion of the glass insulators were captured by the Matabele natives and were worn suspended from their necks.

At the close of the war a considerable amount of material had to be shipped to replace that lost and destroyed, so that about two years were occupied in completing the erection of the plant.

Our artist has embellished the photographs with some typical scenes in connection with the transportation and erection of the plant.

PRODUCTS OF THE ELECTRIC FURNACE

AN ACCOUNT OF THE FIRST PRODUCTION OF CALCIUM CARBIDE AND ACETYLENE IN THE UNITED STATES.

Written for the "American Manufacturer" by F. P. Venable.

In view of the growing importance of the carbide industry and the rapid introduction of acetylene as an illuminant, the history of the first production of this substance in the United States and the discovery of its properties has an especial interest.

The little village of Spray, in Rockingham County, N. C., near the junction of the Smith and Dan rivers, on account of its seclusion and fine water power, offered an attractive location for inventors trying to solve the problem of the cheap production of aluminum. Here the Willson Aluminum Co. erected its plant, and early in 1892 was busied with its experiments. Within a few hundred yards was the abandoned plant of another aluminum company, which had given up the hope of a successful issue to its efforts at making a fortune out of the white metal, leaving dynamos, and furnaces as the only available assets for those who had furnished the needed capital.

As Mr. Willson, the inventor and electrician of the Willson Aluminum Co., seemed to be making little progress towards the perfection of his process for producing aluminum, I was called in during the latter part of June, 1892, to look into the experiments and give an opinion as to the results to be expected from them, the financial backers of the enterprise having become somewhat anxious for more definite progress toward success.

I found that Mr. Willson had attacked his problem from many different sides. Among other plans, he had conceived the idea of preparing some more positive element, like calcium, and making use of this to liberate aluminum from the oxide. In his efforts at producing calcium he had mixed lime with tar and other forms of carbon, and treated these mixtures in his furnace. In this way he had produced a hard, crystalline mass, which disintegrated and crumbled on exposure to the air and gave rise to a violent evolution of a gas when brought in contact with water. This gas was inflammable, burning with a very smoky flame.

Naturally, this substance was looked upon as quite a curiosity, but since there was no very evident mode of utilizing it in the manufacture of aluminum, little importance was attached to it, and most of the stock of it on hand was given to me, on leaving, for my laboratory.

In conjunction with Mr. W. R. Kenan, one of my students, I spent a portion of the summer in studying the composition and properties of this body, and of some aluminum carbide which I had procured at the same time. These experiments were continued during the fall of 1892, but were interrupted by class work and other engagements. Still it was, of course, easy to recognize that we were dealing with a carbide of calcium. The analyses were unsatisfactory on account of the presence of graphite particles and of the partial decomposition of the specimens.

A more important question to settle was the nature of the gas evolved. That it must be a hydro-carbon was a conclusion easily reached and the smoky flame with which it burned, separating large flakes of soot, pointed to a very large proportion of carbon. When the strong unpleasant smell was also taken into consideration, the choice among the known gaseous hydrocarbons was very limited. Under my direction Mr. Kenan passed some of the gas through an ammoniacal copper solution and immediately a copious precipitate was produced which was recognized without difficulty as copper acetylide.

Here, then, was a comparative cheap and easy method of producing acetylene in any desired quantities, and immediately the thought of its illuminating qualities in coal gas and the possibility of using it as an illuminant occurred to me. My first idea was to overcome the smokiness by mixing with a large proportion of air. On trying a mixture of one part of acetylene with four or five parts of air, using an ordinary bat-wing burner, the wonderful brilliancy and beauty of the light were revealed. I was, therefore, the first in this country to see this really remarkable light.

At my suggestion Mr. Willson and one of the other officers of the Willson Aluminum Co. visited my laboratory and examined the light given by the burning acetylene, and we formulated plans for its introduction. The carbide, when treated with water, was found to yield from 3.2 to 3.7 cubic feet of gas per pound. Photometric measures were made, and after one sharp explosion of the mixture with air I began to experiment upon some better way of burning it. These experiments were in the direction of either a neutral gas as a dilutent or the use of the acetylene alone with improved burners. The generators were of the simplest description and ordinary tin gasometers were used for storage. A little care and watchfulness prevented any repetition of the explosion experience. These experiments were carried out during the spring of 1893. After considering the expense of the production my belief was rather that acetylene would probably find its chief utilization in carburetting water gas or other gases low in illuminating power.

To get the new gas on a commercial footing it was necessary to have at least an approximate knowledge as to its cost. This was very difficult under the conditions of the working of the plant at Spray. Besides, difficulties and objections were raised by the holders of gas interests in New York. It was a year or so later that the matter was pressed to a successful issue and the introduction of the new illuminant was accomplished.

Such were the very modest beginnings six years ago of that which has since grown into a great world-wide industry, with many books written concerning it, periodicals devoted to its advancement and immense capital invested in the plants for its production and use. The Germans, with their talent for classification, have already adopted a special name for the scientific expert engaged in the acetylene industry, and he is now duly labeled "Acetyleniker."

Univ. N. C.

(In the attempt to substitute calcium for aluminum in copper alloys, some metal was produced at Spray with as much as 4 per cent. of calcium.—Ed. "American Manufacturer.")

Greencastle, Ind.—Putnam County Telephone Co. has been incorporated by J. Richardson, F. G. Gilman and C. C. Hurst. Capital stock, $10,000.

ELECTRO-THERAPEUTICS.

MODERN ELECTRO-MEDICAL APPARTUS.

Of the various means employed in the production of the electric current, the first to be of any practial value was the liquid cell; and of all the cells with which experiments were conducted, it was finally found that the Leclanche form of battery possessed the greatest constancy. J. C. Vetter & Co. (E. B. Meyrowitz, successor) were first to make use of these cells in the construction of their apparatus; there was, however, not only the objection that electrolyte was a liquid, but there was also their great bulk and consequent lack of portability. When the need of a portable cell, which should also be dry (by reason of climatic and other conditions rendering is impossible to employ wet cells), made itself felt, this firm conducted a series of experiments which finally led to the production of a dry cell, throughout the country (more particularly in hospitals and sanitariums, where local plants are in use) has created a demand for controlling devices by which the dynamic current may be employed with equal safety and scientific accuracy. The difficulties met with in this case were the high amperage and the great voltage of such a current; all the Vetter apparatus is so constructed as to absolutely limit the amperage obtainable, and also to reduce the voltage in such a manner that a current in single volts, from 1 to 110, can be obtained, and this current again be controlled so as to reduce the amperage to the fraction of a milliampere. This places in the hands of the medical profession a means of obtaining an inexhaustible source of electricity, which may be manipulated with absolute safety to the patient.

One of the most popular electrical devices manufactured by this firm is the Vetter Current Tap. This simple device will be found useful wherever the Constant Electric Current is employed

Electro-Therapeutical Table for Galvanism and Faradization.

which, while embodying the component parts of the Leclanche cell, together with its lasting qualities, had also the advantage of being portable.

At the time of the World's Fair, this firm among other exhibitors, submitted their cells to a test, which was presided over by a committee of experts, and the result was that the Vetter Dry Cell received the award, which reads: "For high electromotive force, for low rate of polarization, and for constancy of action."

At the same time that these experiments were being carried on with the cells, it became necessary to provide controlling devices for the scientific application of the electric current, and the Carbon Current Controller and the Standard Mil-am-Meter were the result. These instruments are employed in all the Vetter apparatus at the present time, and are admitted to be the best of their kind in the field of electro-therapeutics.

The general introduction of the electric current into offices for lighting purposes, as it is designed to facilitate the transmission of the light or power of the current to any desired point in the vicinity of the fixture, without the loss of the lamp at the point where the current is taken. As the name indicates, it "taps" the current, and does it in so simple a manner that a novice can use it without the slightest difficulty. The Current Tap is made in two styles, viz.: Parallel and Series.

FOR OFFICE USE.

To obtain a drop light for the desk, place a Vetter Parallel Current Tap in the wall bracket, replace the lamp and carry the conducting cords to the desk lamp. You will have two lights where there was only one.

An electric Fan can be operated at the same time from the same tap, thus giving two lights and a fan motor from one outlet.

FOR FACTORY USE.

A good light can be carried to any part of the Lathe, Printing

Press or wherever a light is desired, by the use of the Vetter Parallel Current Tap, inserted in the ordinary hanging or fixture socket.

FOR THE SICK ROOM.

The Vetter Current Tap will be found a comfort in the sick room. When inserted in the wall bracket, it will furnish, by means of the conducting cords, the current for a fan motor to any part of the room, without loss of light at the wall bracket.

FOR PHYSICIAN'S USE.

The Vetter Series Current Tap is a ready means to obtain the current for the Head Lamp, Galvanic or Faradic Apparatus from the electric light fixture, using the lamp in the Current Tap to modify the current.

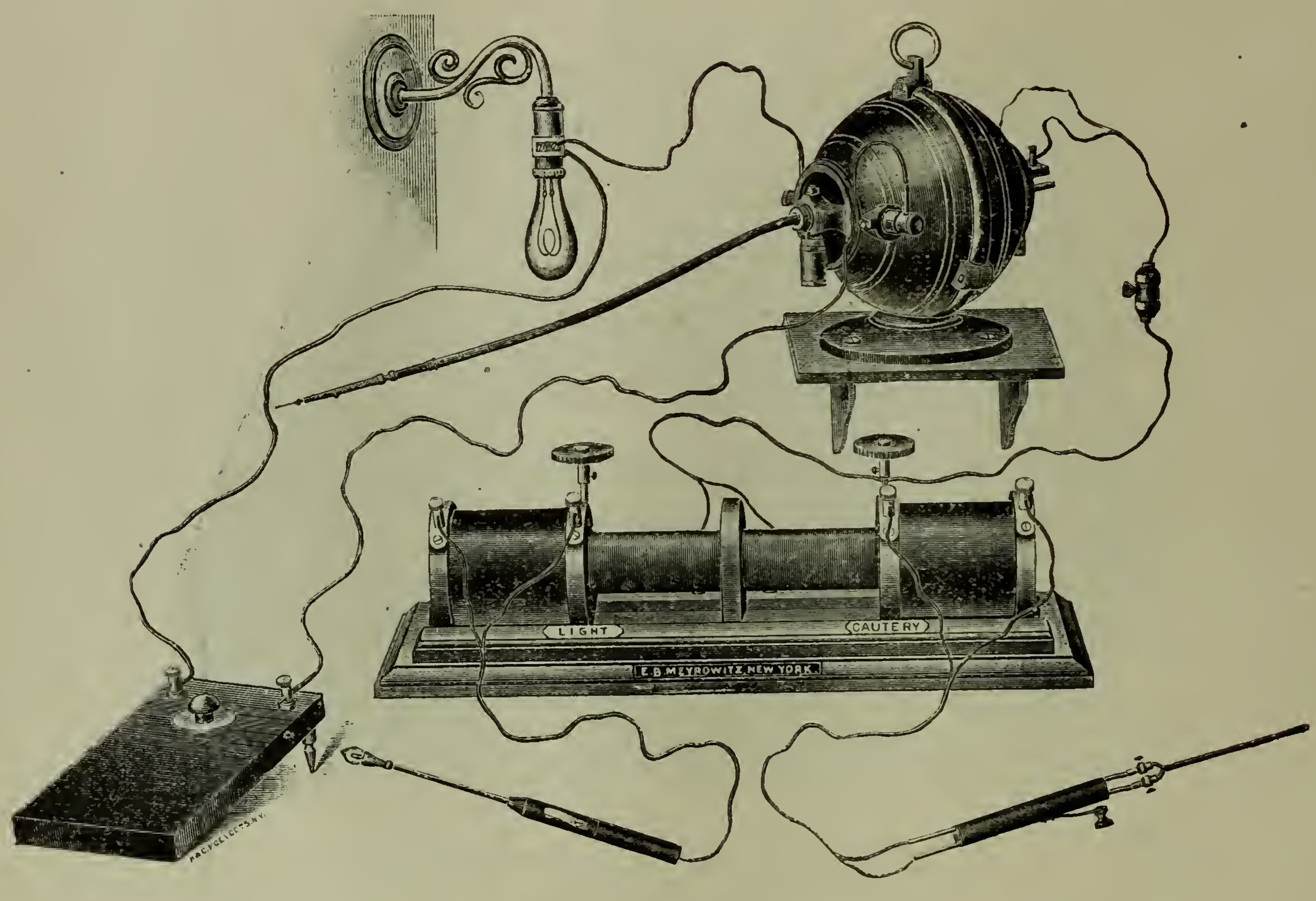
FOR CHARGING STORAGE BATTERIES.

This tap is particularly well adapted for charging storage batteries; the ampere flow of the current is regulated by the C.P. of the lamp in the tap. A table of same will be found in the directions which accompany each Tap.

BICYCLE LAMPS.

Bicycle lamps operated by storage batteries can be charged from any electric fixture on the Direct Electric Current by means of the Vetter Series Current Tap, with a lamp placed in the same. Full directions, giving the ampere capacity of lamps according to C.P., accompany each Tap.

For a number of years Mr. Meyrowitz was the managing and financial partner of the firm of J. C. Vetter & Co., and upon the dissolution of this firm by limitation, on Nov. 1, 1897, the entire assets, including all the patents, were acquired by him, and incorporated as the Electrical Department of the firm of E. B. Meyrowitz, with stores at 104 East Twenty-third street, and 125 West Forty-second street, New York; also at Minneapolis and St. Paul. It is confidently believed that the amalgamation of this Department with the other scientific branches of this firm will tend to place at the disposal of the Medical Profession Electro-Medical Apparatus of the greatest accuracy and highest grade of mechanical construction. Their newly issued illustrated 73-page catalogue will be sent free upon request.



Cautery and Lamp Controller With Surgical Motor.

POWER TRANSMISSION.

ELECTRIC POWER TRANSMISSION IN ITALY.

The power transmission from Paderno (Italy) to Milan, 33 km., or 20 miles, in length, has recently been opened for service, and supplies energy for working (by rotary conversion) the extensive continuous current tramway system, as well as for lighting and for industrial purposes, in the city, says the London "Engineer." The available power of the River Adda at Paderno is, at a minimum, 45 c. m. per second, and the fall 28 m., equal to 13,000 horse power, of which 10,000 horse power is at present utilized. The power station at Paderno comprises four turbines with horizontal axis, making 180 revolutions per minute, supplied by Messrs. Riva Mounerat & Co., of Milan, and four direct-coupled 2,500 horse power three-phase generators, designed and constructed by Messrs. Brown, Boveri & Co., of Baden, Switzerland. The normal tension is 14,500 volts, but trials have been made up to 21,000 volts. The generators, which at the trials gave an output equal to 3,000 horse power, are the most powerful three-phase machines yet built in Europe; and the practical results achieved confirm in every respect the theoretical forecast. The installation has worked without a hitch from the day of its being opened for service, and marks an important advance in high-tension transmission over long distances.

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CONTENTS:

LIGHTNING ARRESTERS.

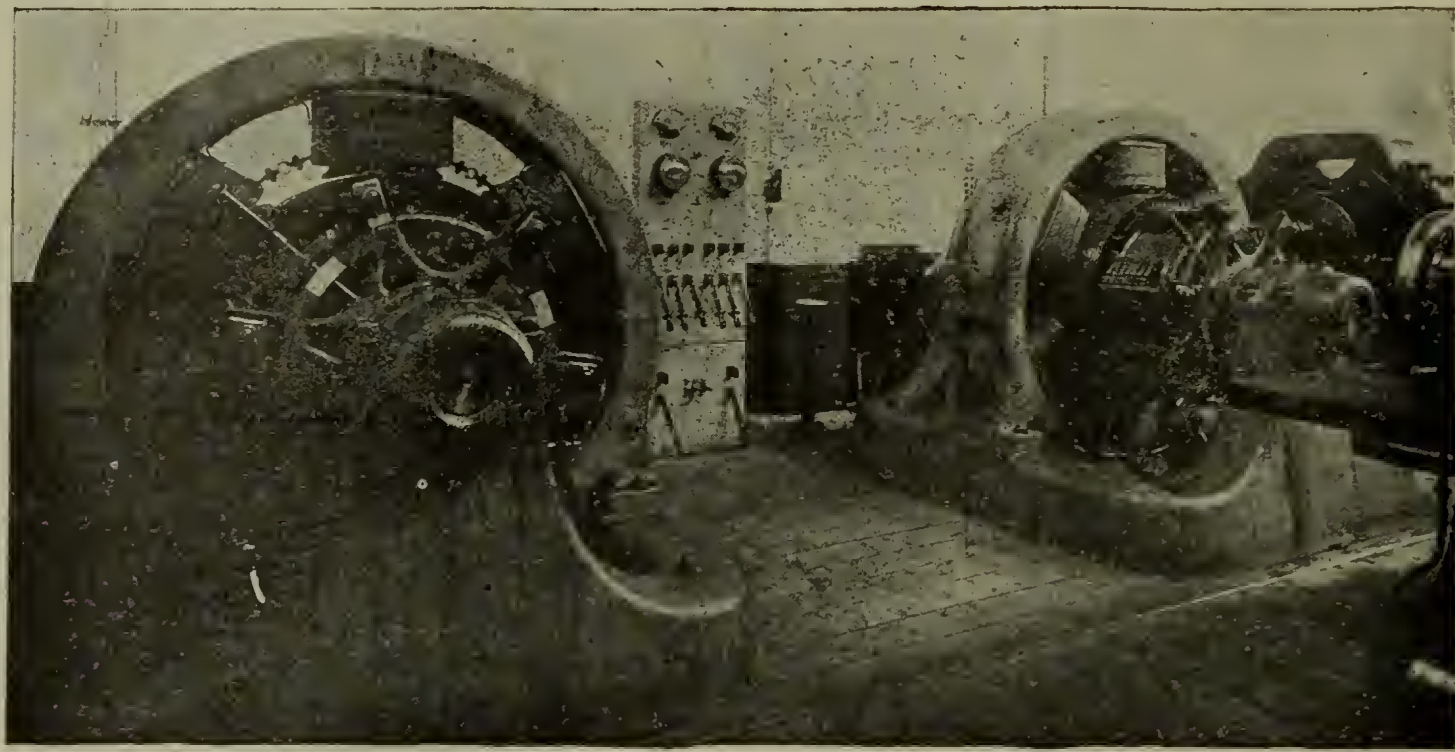
The art of making lightning arresters is in certain respects a new one. Recent types have shown not only a radical departure in construction, but a knowledge of principles whose value in relation to arresters was until lately not appreciated. The lightning rod and the lightning arrester differ from each other both in principle and construction. There are many who believe they are identical. To arrest a lightning discharge means the pursuit of an entirely different idea to that involved in the design of a device which merely leads a high potential discharge to earth. In this last statement we may have erred, because of the fact that a lightning rod is as apt to allow a discharge of escape from the earth into the charged atmosphere above, as the converse. But aside from this, lightning arresters used on circuits, for their protection, carrying pressures of ten, twenty, or even fifty thousand volts, shows the necessity for such improvements in their construction as to insure freedom from danger. Both choke coils and arresters properly arranged with respect to each other represent the modern idea of an effective device serving the purpose above described. Some of the manufacturing concerns are sufficiently well interested in the welfare of their customers to supply them with sketches and directions for connecting up their lightning arresters. Any one purchasing apparatus of this description can hardly offer excuses if they fail to operate and were originally well made. The grounding of the arrester and the relative positions of the choke coil and arrester itself have largely to do with the success anticipated. The fundamental principle upon which lightning arresters depend for their construction is that a slight impedence in the form of a choke coil will interfere with the discharge continuing over the line to the generators, but will still provide through the medium of the arrester an opportunity for the discharge to leap to earth through the ground connection. The choke coil is generally placed between the lightning arresters and the dynamo; in fact, for many types of arrester any other position is undesirable. The difficulty in many cases with lightning arresters is directly traceable to their ineffectiveness with certain kinds of disruptive discharges. It is almost as necessary for a lightning arrester to be regulated between certain limits so as to meet every injurious discharge as to follow out any other line of reasoning in connection with generator or line and provide against contingencies arising there. We give to our readers a recipe, not exactly taken from the cook book, for making a good ground connection: "First, dig a hole six feet square directly under the arresters until permanently damp earth has been reached; second, cover the bottom of this hole with two feet of crushed coke or charcoal, about pea size; third, over this lay twenty-five square feet of No. 16 tin copper plate; fourth, solder the ground wire, preferable No. 0 copper, securely across the entire surface of the ground plate; fifth, cover the ground plate with two feet of crushed coke or charcoal; and sixth, fill in the hole with earth, using running water to settle." The above method of making a ground connection is simple, and has been found to give excellent results, and yet if not made in proper soil it would prove of little value as a connection to earth. Where a mountain stream is conveniently near, it is not uncommon to throw the ground plate into the bed of the stream. This, however, makes a poor ground connection, owing to the high resistance of the pure water and the rocky bottom of the stream. Clay, even when wet, rock, sand, gravel, dry earth and pure water are not suitable material in which to bury the ground plate of a bank of lightning arresters. Rich soil is the best. It is, therefore, advisable before installing a bank of choke coils and lightning arresters, to select the best possible site for the lightning arrester installation, with reference to a good ground connection. This may often be at some little distance from the station, in which case it is, of course, necessary to construct a lightning arrester house. Where permanent dampness cannot be reached, it is recommended that water be supplied to the ground plate through a pipe from some convenient source." In erecting telegraph lines in Vermont the ground return was found to possess so high a resistance that it was necessary at times to depend upon an exceedingly sensitive relay for receiving signals. The rocky bed of Vermont was entirely responsible for this state of affairs, although a little investigation in all probability would have saved any annoyance on this score. The grounding of telegraph wires is of no greater consequence than is the case of a device without which an entire power station might be destroyed during a thunder storm. It seems evident that a little judgment in deciding upon the best place to ground a wire might add to the successes and eradicate many failures.

PRIMARY BATTERIES AND ONE WATT LAMPS.

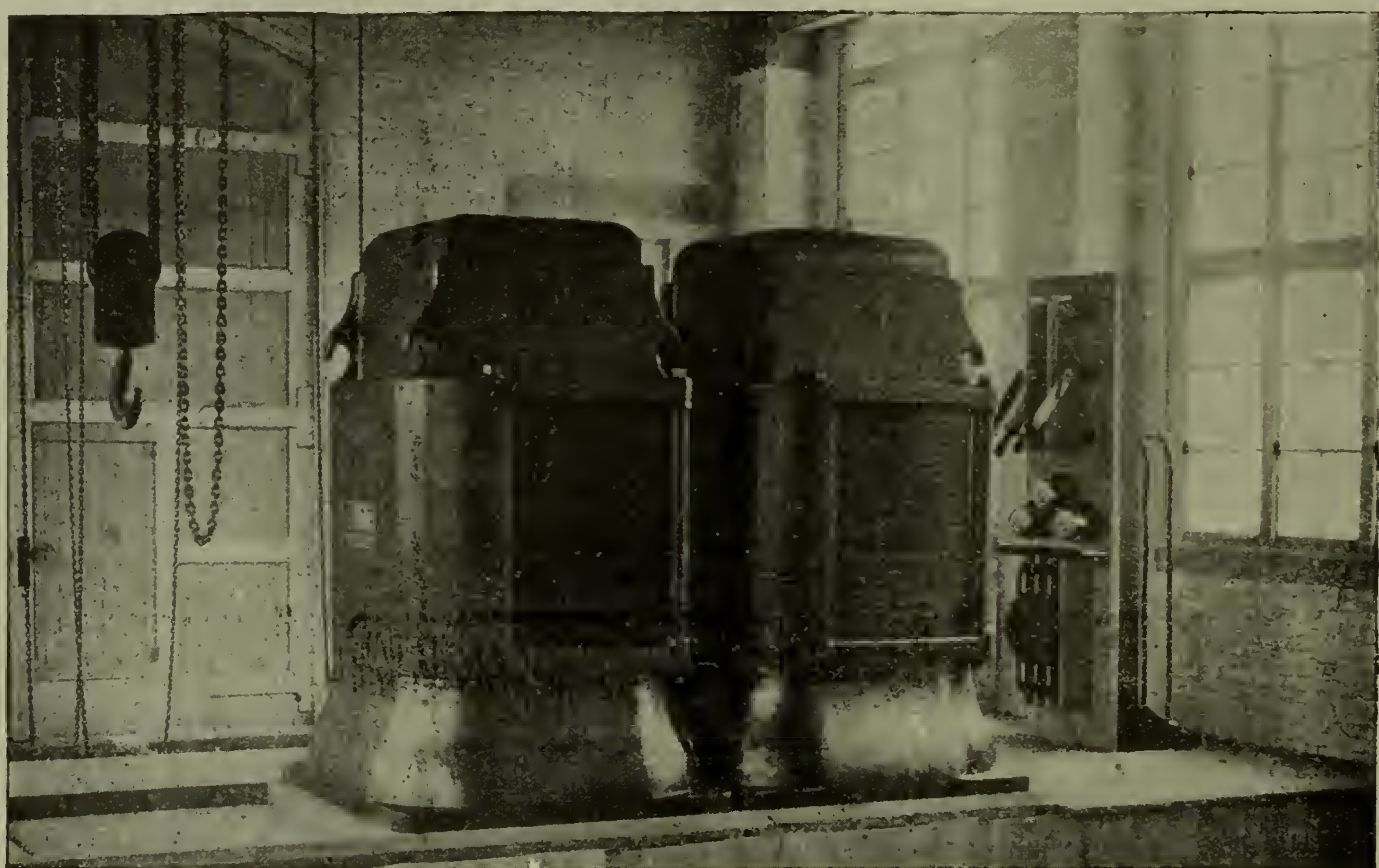
The changes of the moon are not more frequent that the advent of primary batteries upon the market. We might add to this by saying that the constellations do not embrace so wide a variety of planets as inventors have placed before a confiding public in the shape of primary batteries. Yet the primary battery may some day occupy a position of greater dignity in the field of electric lighting than at present. The consumption of zinc in acids is twenty times as expensive as the combustion of coal. But the three-watt lamp does not add any to the beauties of the situation, as far as efficient lighting is concerned. On the other hand, a one-watt lamp fed from a primary battery reduces this ratio down to only six times the expense of lighting with dynamo, engine and boiler. The first cost of a set of primary batteries is much less than that of a dynamo plant. There are certain other features of interest which we cannot help acknowledging, such as the small space a battery equipment would occupy and the ease with which the domestic world could handle them. It may be that the primary battery and one-watt lamp will move a little further to the front in the near future than we anticipate.

POWER ACROSS A MOUNTAIN RANGE.

In the Western part of this country the mining districts afford the casual visitor an opportunity of seeing several large transmission plants, which send power a distance of less than a hundred miles away to certain centers absolutely dependent upon them. The pressure used on such lines varies from 5,000 to 50,000 volts. The general efficiency of the plant in operation reaches as high as 70 per cent. The Westinghouse Electric & Manufacturing Co., the General Electric Co. and the Stanley Electric Manufacturing Co. have had a great deal to do with the power development in the West. The Tesla polyphase motor, by means of which power transmission with alternating currents became an established fact, has entirely fulfilled the expectations of its manufacturers. The various polyphase systems in the West, brought into existence by the great water powers there, have offered inducements to capitalists in the line of mining investments, which have generally assured them of a certain and profitable return for their time and money. Along the Western coast the waves of the Pacific are now being used by means of ingeniously constructed pumps, which store up water in large tanks under high pressure. This water at full head is allowed to discharge into a Pelton wheel, which drives the generators, the power from which may be transmitted to any point desired. All the characteristics of a long distance transmission plant are present in this case, and it is, therefore, merely another type of Western enterprise.



Motor Generators Used in Power Transmission.



High Tension Transformers for Power Transmission.

TELEGRAPHING WITHOUT WIRES.

PROF. LODGE ON SPACE TELEGRAPHY.

Prof. Lodge's lecture at the Institution of Electrical Engineers on "Improvements in Magnetic Space Telegraphy," is more than a description of a new system; it is a criticism of old methods and a study of their limitations, followed by a look ahead into the possibilities of ship and shore signaling. To begin with, he gave his hearers a careful explanation of the difference in quality and functions between the magnetic induction exerted between wire and wire, as in the Lavernock experiments, and the progressive waves that are emitted by a Hertz oscillator. The distinction between the two kinds was illustrated by the case of a magnet "wobbled" slowly on one side of a sheet of copper, in which case a compass-needle on the other side of the sheet is affected; and a magnet "wobbled" fast, in which case the needle does not respond. A magnetic alternation of sufficient rapidity induces an alternating electrostatic field, and is, therefore, accompanied by emission of energy; but a slow magnetic alternation is practically unaccompanied by electrostatic effects, and practically all the energy emitted at each pulsation returns to the source.

The new system of telegraphy, now suggested by Prof. Lodge, is the outcome of his well-known experiment on "tuned" circuits, where two similar Leyden jars, each provided with a suitable metallic circuit, are made to respond to one another at a distance. Instrument makers were reminded that when they design the apparatus for this experiment, the areas of the resonating circuit should be carefully attended to; as a rule, they are made too small and too cramped; all the joints should be soldered, and chains, "which are an abomination," should be avoided, the circuit should be so well jointed that a thermopile will send an appreciable current through it. In the experiments on signaling the Leyden jars are replaced by condensers of several microfarads capacity; the resonating metallic loops are enlarged into inductive coils of great area arranged horizontally; and the influence machine gives place to an alternate current dynamo. Lastly, the receiving apparatus is geared up by a train of telephonic relays, so that the diaphragm of the last telephone of the train vibrates with sufficient violence to make an electric contact, which in turn can operate a telegraphic instrument.

The discussion on the lecture promises to elicit some important information with regard to the effect of sea water on the attenuation of electric waves. This question has been gone into mathematically by Mr. Whitehead in a Physical Society paper. He finds that the loss due to twenty miles of traversed sea water is 79 per cent. of the initial electric impulse. Prof. Lodge seems rather unwilling to accept these figures; his objection is based on the assumption that the reacting currents, which are really responsible for the attenuation, are, at considerable distances from the source, extremely feeble. According to Prof. Lodge, the only conductors that interfere between the primary and secondary coils, in such a case, are such as have a position near one or other of the coils. A single conductor exerts its greatest obstructive power when it is placed half way between the primary and secondary coils; but if the coils are far from one another, the effect, in Prof. Lodge's opinion, is almost negligible. Moreover, he points out that Mr. Whitehead's calculations appear to be developed from differential equations which assume that the sending circuit emits true waves. And while it is the fact, as demonstrated by Prof. J. J. Thomson, that a Hertz oscillator in a trough of liquid has its oscillations absorbed with great rapidity, the same does not necessarily hold for a simple fluctuating magnetic field. Prof. Lodge suggests that the sea water question might be compromised by putting one horizontal coil on shore, and another, in the same plane with it, on the ship.

WIRELESS TELEGRAPHY.

Some experiments have recently been made in Paris between the Eiffel Tower and the Pantheon, a distance of about two and one-half miles. The signals, even during a time of dense fog, were quite sharply defined. The transmitting apparatus was fixed on the third platform of the Tower, and consisted of an induction coil giving a ten-inch spark, and an oscillator, from one of the spheres of which a radiatory wire was hung. The other terminal was connected to the metal work of the Tower itself, which thus formed the "earth." It was noted that under these conditions the length of the spark obtainable was greatly diminished, probably owing to the great capacity of the system formed by the tower and the radiator. The receiving apparatus was installed in the Pantheon with a collecting wire 140 feet long. Excellent signals were obtained, a Morse recorder being worked without difficulty. "L'Industrie Electrique" of Nov. 25, gives a good illustraion and description of the apparatus used.

ELECTROLYSIS.

ELECTROLYTIC TUNGSTEN.

A few months ago, Moissan signalled the preparation of pure calcium, which not being contaminated with its yellow nitrogen compound, appeared silvery white, malleable, and ductile. From his continued researches we learn that calcium may be cut with a knife; its fracture is crystalline, it scratches lead, is less malleable than sodium, has a specific gravity of 1.85, decomposes water, and is hardly attacked by chlorine at ordinary temperature. Hallopeau has now succeeded in preparing electrolytic tungsten by electrolysis of fused paratungstate of lithium at a temperature of 1,000 degrees cent., with electrodes of platinum. The electrolysis with currents of .3 amperes and 15 volts lasted three hours. The product was successively lixiviated with hot water, concentrated hydrochloric acid, a hot solution of lithium oxide, and again with water. The residue showed crystals of tungsten, generally needles, opaque, of metallic luster. They still contain up to 6 per cent. of platinum, the electrodes having dissolved in the fused lithium oxide. Hallopeau will try platinum-iridium electrodes. His paper was presented to the French Academy; almost all the other papers by Gin, Lebeau, Leleux, Williams, etc., on electrolysis in the furnace have come before this body.

ELECTROLYSIS OF CAST IRON PIPES.

In view of the suit, says the "American Manufacturer," that has recently been brought in the city of Atlanta to determine the responsibility for damage to pipes caused by the proximity of electric underground wires, the following observations by Mr. H. P. Brown, an English engineer, before the Municipal Improvement Association, may be of interest.

Mr. Brown said: The immunity of cast iron pipes from electrolytic action has generally been accepted, although it was known that lead and wrought iron pipes could be and were affected within a radius of half a mile from the power house. But recently some cast iron pipes were found to be badly corroded underneath the covering of black paint. Seemingly they were in fair condition, but on scraping away the paint, the pipe could easily be cut with a knife. Sections of the pipe were removed and tested. Under the electrical test it was found that at a distance of 1½ to 2 miles from the power house the pipes were positive to the rails, and therefore susceptible to corrosion. In the town itself the highest voltage observed was 4½, but near the power house the voltage rose to 9, and the area of danger extended in one direction for three-quarters of a mile. Usually, the sand that adheres to the pipe and the coating of tar that it receives protect it from electrolytic action, and in ordinary soils the layer of oxide of iron, formed by the action of the current, being a poor conductor of electricity, also helps to prevent corrosion. But Mr. Brown points out that tar is not a sufficient protection for cast iron pipe, as under the action of the current it is changed into a material resembling graphite and is an excellent conductor. He has observed that in the vicinity of pipes which have been corroded the stones and pebbles are actually coated with a thin layer of metallic iron, a new circumstance in the history of such cases. A chemical analysis of the corroded pipe showed that the percentage of carbon was more

than doubled. In other words, the iron was removed and the carbon left. He thinks that the corrosion was due to the presence of carbonate and chloride of sodium in the soil, the passage of the current decomposing them with the formation of muriatic acid, which at once eats into the pipe and ultimately destroys it, without to any great extent altering the outside appearance of the pipe.

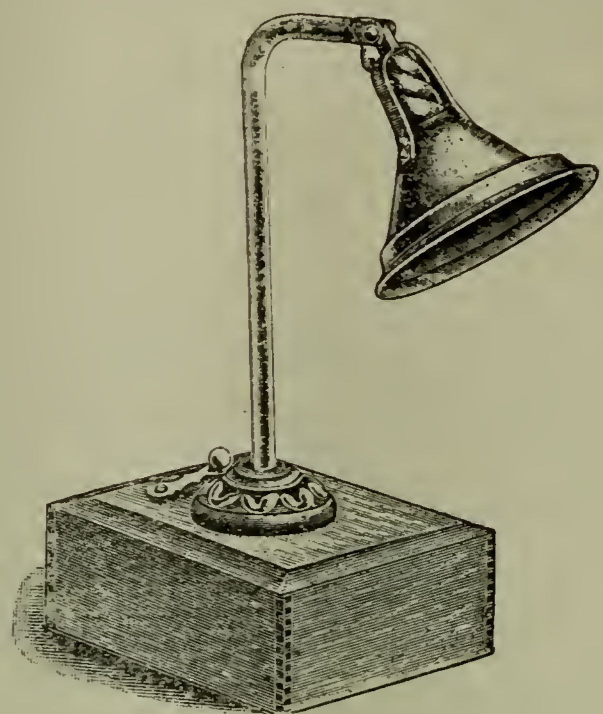
He then sought to determine the amount of electrical pressure necessary to injure the pipe. Starting with a maximum pressure of three volts he found that the graphite coating did not exceed the one-thirty-second of an inch in thickness, and the iron was practically unaffected. Above three volts the thickness of the graphite layer increases with the length of time during which the pipe is exposed to the current, and soft spots, varying in depth from one-sixteenth to one-quarter of an inch, can be found. As the voltage increases the corrosion increases, and the damage is directly proportional to the pressure and time of exposure, but is inversely proportional to the distance between the pipe and the rail. Mr. Brown does not say so, but the electrolysis of pipe is largely a matter of proper bonding of the rails. We were shown, not long since, a piece of wrought iron pipe that was literally eaten up by electrolytic action. It had been laid about two years and was within two feet of the rails and about three hundred yards of the power house.

Under proper bonding the liability of corrosion is greatly reduced, but is not entirely removed.

ELECTRICAL NOVELTIES.

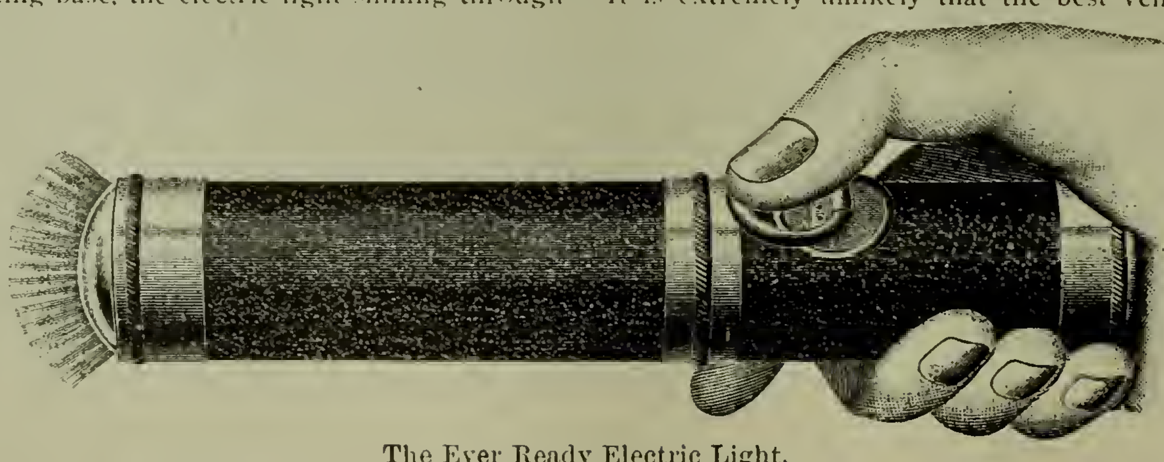
TWO USEFUL INVENTIONS.

Amateur photographers will undoubtedly feel very grateful to



The Ever Ready Electric Ruby Lamp.

the manufacturers of the "Ever Ready Electric Ruby Lamp." This consists of a minature electric light, with battery outfit contained in a supporting base, the electric light shining through



The Ever Ready Electric Light.

a ruby glass. This portable, convenient and ever ready lamp can be carried around, turned on in a moment and replenished with an extra battery after many hours of use with the utmost facility. In summer it gives no heat, and in winter as well the amateur is not confined to any one room. He may work in comfort and warmth, aided by a strong, steady and blood-red light. This lamp, complete, with battery, switch, etc., costs $3.50. We cannot speak too highly of this valuable innovation.

The "Ever Ready Electric Light," which is the sort of electric candle no household can afford to be without, is exactly what the public have been waiting for for the last ten years. The most explosive mixture of gas remains unaffected by this lamp, which, depending upon no outside conditions for its illumination, is free to burn anywhere and everywhere. The night watchman, policeman, gas inspector, physician and an endless list of other people, after once using the "Ever Ready Electric Light" will regard it as necessary an article of general use as any other utensil known to the home. The No. 1 pocket size may be used 8,000 times before renewal. An extra battery for this purpose costs 30 cents, and the price of the outfit complete, $3. Larger sizes of greater candle power are kept in stock by the American Novelty & Manufacturing Co., 353 Broadway, New York City.

INSULATION.

A NEW SOURCE OF MICA.

In five or six localities in Coorg, India, sheets of mica, well up to the marketable size, have been obtained. The largest were, says the Royal Institute "Journal," procured on Elk Hill, where, from immediately under the soil, sheets, free from warping, and measuring some thirty inches across, were removed from the outcrop of the vein. All samples show a high degree of elasticity and good color, but much of the material will have its value depreciated by ferruginous inclusions between the cleavage planes, while some of the mica is badly warped. It is extremely unlikely that the best veins have been the first to be "struck" in an area so completely soil covered, but enough has been shown to prove that the mica bearing pegmatites extend over a wide area, and will probably be a source of profit if worked with discretion.

STORAGE BATTERIES.

THE STORAGE BATTERY.

A correspondent of the "Daily Mail," of London, notes that as soon as electricians are able to store the same amount of energy in 1 lb. weight of battery as can be obtained in 1 lb. of coal, the motive power of the naval and mercantile marine will undoubtedly be electricity from storage batteries carried in space now occupied by the bilges, and working three or more propeller shafts coupled direct on to dynamos running at about 1,500 revolutions per minute, controlled from the bridge, and requiring not more than one or two attendants, even in the largest vessels having battery power sufficient to take them half way round the world without recharging.—Ex.

TIPS ON TRADE JOURNALS.

A MODERN PHOENIX.

The majority of our readers are doubtless acquainted with the famous peculiarity of that fabled bird of the ancients, the phoenix, which enabled it to arise, more glorious than ever, from a blazing and devouring fire. "Locomotive Engineering," the organ of the railway profession, seems to be in some way related to the marvelous bird, judging from the experience it has just passed through. Its offices in the Home Life Building were destroyed by fire on Dec. 4, leaving it without cuts and copy for the next issue, but—surprising to relate—the January number has come to hand as prompt as its predecessors, and just as interesting and handsome, if not more so. We take off our hats to "Locomotive Engineering" for this example of pluck and hustle.

OPINIONS OF EXPERTS.

SOME REMARKS ON THE PERFORMANCE OF ELECTRICAL APPARATUS ON SHIPBOARD DURING THE LATE WAR WITH SPAIN.

Paper read before the New York Electrical Society.

By F. W. Roller.

In addressing the society this evening, let me preface my remarks with the statement that much of what I shall have to say is based on heresay evidence, as is necessarily the case, but that the opinions of the numerous other officers with whom I have spoken on the subject seemed to agree so well that I believe you may take the conclusions as generally correct.

In the first place we will divide the electrical appliances that we had into different classes and compare them.

The first of these will include the indicating apparatus, such as the engine room and order telegraphs, speed and direction indicators, helm angle indicators and the range finder. All of these instruments are of the galvanometer type, there being a galvanometer at the receiving end, with its scale divided in yards, range, degrees, revolutions or arbitrary orders, instead of volts or amperes, and actuated by differences of potential produced at their terminals from the sending end. They are, in consequence, delicate in construction and easily get out of adjustment, but they have the advantage of flexibility and possibility of the use of a large number of receiving stations, as well as the minor one of requiring inappreciable amounts of energy.

In general it may be said that their performance was not satisfactory. In some cases, say that of the range finder, the trouble cannot be attributed entirely to electrical reasons. In this instrument, where we in reality measure the altitude of a triangle from the known base line (the distance betwen the two telescopes) and the angles adjacent thereto (those made by the telescopes with the base line when bearing on the target) the base is so very short in comparison to the other two sides, that unless the glasses are very carefully trained and the whole appartus in perfect adjustment, a very considerable error will arise. It is easy to see how large this error may be when we know that the glasses could only in the most advantageous cases be placed as far as 300 feet apart, and that the minimum distance from the target that it is likely that they will commence to be used is 3,000 yards; the altitude is here thirty times the base. In addition to this, I understand that the device in several cases proved to be unable to withstand the concussion of the great gun fire. Under the circumstances it is natural that their use should have been largely abandoned, and instead, the secondary battery used. With the great rapidity of fire of this, it was easy to take a large rapid fire gun, load with common shell, estimate the distance by eye, run up the sights for that, and fire. If a hit was made, that was the range; if not, the shell would be seen as it struck the water, the sights readjusted accordingly, and, the gun having been reloaded in the mean time, another shot taken. It was rarely necessary to make more than two or three trials of this kind before the range was had to a nicety, and then the main battery could be opened up. But let us return to our subject of the instruments.

They had another feature that contributed to their lack of success, which was the difficulty of locating any derangement that might arise. The men were used only to mechanical devices, and a fault that could neither be seen nor detected by the ear seemed to them most mysterious outside of the fact that the testing, even when understood, was none too simple. and was rendered still more difficult by the surrounding conditions. As a consequence, but few troubles made them disgusted, and the instruments got the reputation of being far worse than they were.

There is one other class of electric device that can be said to fall in this first class, in that it employs currents of small strength. This is the electric firing arrangement that was used on some of the rapid-fire guns. But few of the ships were fitted with this; the "Nashville" was one, and although we had on the whole the most satisfactory results from it, two or three of the others had, I understand, some trouble from miss fires.

This, however, was undoubtedly due to the low battery power furnished to set off the primers, there being a little case holding three small sized dry cells, secured to the gun mounts, which were supposed to give all that was required. They did, as a rule, but dry batteries are not any too reliable, anyway, and standing exposed in a metal case to the intense rays of the sun day in and day out, did not tend to help matters any. A more powerful type of cell would undoubtedly render them perfectly certain in their action, and as the breech plugs fitted for electric firing are far more simple mechanically than the other types, there is little doubt but that they will be permanently retained.

Leaving now our first general class, we come to class number 2. This includes all appliances requiring considerable amounts of current for their operation, and takes in the incandescent lamps, the search lights and the motors.

It may appear strange that special stress should be laid here to the incandescent lamp, as its advantages seem obvious; but it is of extreme value in many ways that are not so apparent at first glance. If we take the easy control of all the lights from a central point, for instance, here alone is a point of the greatest importance. On a regular man-of-war all of the lights that are out of sight and those necessary for the operation of the guns at night, which are fitted with shields to obscure them, are grouped on a common "battle circuit," so that under war conditions all of the other circuit switches may be opened at sundown with the perfect assurance that after that there will be no glimmer of light to betray the vessel's position. On the auxiliary vessels that we had there was no such provision, with the consequence that in spite of the vigilance of the officers, they were bound to be found sooner or later with an unauthorized light going somewhere.

It was easy then to see them at quite a distance, and an enemy's ship would have had a great advantage over them, whether she was chasing or trying to slip by. Another place where the electric light was practically indispensable was for the night signal work.

The regular ships were, of course, fitted with our standard "Ardois" sets, which consist of a string of five lanterns, each half clear glass and half red, inside of each of which were two lamps, either of which could be lit independently, and, by means of a keyboard, the different combinations that formed the signals made. These were always ready, and it was but a second's work to flash the private signal at any craft that was deemed suspicious

before betraying your own position too markedly by turning on the search light or going further and opening fire. The other ships had to have a number of ordinary lanterns ready lit, concealed from observation, which they would bend on a pair of signal halliards and hoist when they had a communication to make; an operation requiring considerable time. That this time element was important is illustrated by an incident which came under my observation while on the Havana blockade in the early part of the war. There the captain of one of our auxiliary vessels fired on another one of them one night, fortunately discovering his error before any harm was done, and explained his action the next morning by stating that he only saw the other craft when she was very close to him and thought that she was something trying to get in; that that was "no time for signals where he had all that lantern business to go through, so he fired first and asked questions afterward."

We now come to the second device in our class two, the search light. The value of this was proven beyond all possibility of doubt in this war; not only was it valuable, but I think we can go much further and say that if it had not been for it there is a strong probability that the war would not even yet be over.

We learned afterward that at Santiago, leaving aside the practical certainty of night attacks from the harbor of the enemy's torpedo boats, which would have stood an excellent chance of success, Cervera had fully determined to make a night dash to escape. This was rendered an impossibility by the search-light beams that were kept on the harbor entrance the night through, which made the place as light as day for the ships that were behind the lights and simply dazzled the eyes of any attempting to get out, rendering the navigation of the tortuous channel exceedingly hazardous and making shooting practically impossible for them. In consequence, he found it on the whole better to make his trial in daylight, with the well-known result. If a night run had been feasible, owing to the lack of the search light, there is a strong probability that the majority, at least, of the Spanish ships would have gotten away clear, and if they had succeeded in making Havana their dislodgement and capture of the town would have been a problem of a far different and more difficult nature. An illustration of the power of the search light may be of interest. Of course, for the purpose of "picking up" an object they are of little use beyond a distance of two, or, perhaps, three miles, but the light is visible at far greater ranges.

I have more than once, when off Havana, seen on the clouds the reflection of the search light that was mounted on the fort at Key West, a distance of over eighty miles, and not only that, been able to follow the course of the beam as it swung from side to side.

Anticipating a query to that effect, I will say that I do not know of any attempt made to communicate with our vessels by this means.

The last of the power consuming class, the motors, I have concluded not to enlarge on, as you are probably all familiar from reading the papers with their performances. The motors for ammunition hoists, turret training, ventilating fan driving, and, in some cases, steering gear, gave results so far more satisfactory than any other method of control and operation that their continued use is firmly established. The few failures that occurred were far less in number than those of their steam driven equivalents, and were even then in most cases traceable more to the lack of familiarity of the men with the apparatus than to any inherent defects of the apparatus. It is needless to go into this any further.

As a result of the foregoing, I think we may fairly conclude that in general the devices that are included in class No. 1 are as at present installed, of questionable utility, but that class 2 was an unqualified success and a monument to the engineering ability of our electrical profession.

Dillon, S. C.—The People's Telephone Co. has been incorporated by C. A. Woods, E. L. Moore and John Willcox.

CONDUCTORS.

TECHNOLOGY OF ALUMINUM FROM A BRITISH STANDPOINT.

At the summer meeting of the Institution of Mechanical Engineers, according to the Journal of the Franklin Institute, held at Derby, Mr. E. Ristori gave the members an account of the present state of the aluminum industry in England, and in connection therewith made some interesting comments on the applications which the pure metal and its alloys had received. From these it appears that the British practice of manufacturing the metal differed in some important features from ours—notably in the use of a different form of furnace, and in the production of a crude metal which is afterwards brought up to high grade by a refining process. The details of this last would be extremely interesting, but none are given. Some useful data were given in reference to the technology of the metal, an abstract of which follows:

Mr. Ristori stated that aluminum could be forged hot or cold, and, in comparison with other metals, it ranks third in order for malleability and sixth for ductility. Sheets have been hammered as thin as 1-40,000 of an inch. In turning, the edge of the tool soon becomes blunt, and the cutting speed should be high. In its purest form aluminum is very soft and not of great service in those arts in which much rigidity and strength were required. One casting alloy having a specific gravity of 2.9 is now largely used, but its composition is still kept secret. It has been found to produce remarkably clean castings, which required very little machining to finish up, and takes a high polish. Another alloy contains aluminum and a small proportion of copper. The two alloys particularly recommended as among the best yet made, are both ternary alloys, and next to the aluminum, tungsten is the leading ingredient in each. In one of them copper is present to a small extent, and in the other nickel, and both have given astonishing results as regards strength and elongation. Samples of rolled sheets or rods made of these alloys show as much as 20 to 22 tons tensile strength per square inch, with 5 to 10 per cent. elongation in 4 inches. Aluminum bronzes are undoubtedly superior in strength, and they are especially suitable for marine engineering. Mr. Ristori gave many illustrations of the uses of aluminum, and speaking broadly, he said that the metal, or one of its light alloys should, to a large extent, replace copper, tin and nickel. Its use in shipbuilding is growing rapidly on account of its great saving in weight. In some cases pure aluminum is not strong enough alone, and it is thought better to use an alloy containing about 6 per cent. of copper. This possesses a tensile strength of 14 tons per square inch, but this material is absolutely untrustworthy in sea water, owing to the rapid corrosive action set up between the two ingredients. Unfortunately, this comparative failure had materially discouraged the adoption of aluminum in shipbuilding, but, eventually, when further experiment have been carried out, there is no reason why a suitable alloy should not be adopted, which, when properly used and protected from direct contact with sea water, would resist corrosion as effectually as the majority of metals now employed.

AMONG THE SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

A meeting of the Institute was held at 12 West Thirty-first street Wednesday evening, Dec. 28. Mr. John E. Lieb, Jr., in the chair. A paper was read by Mr. Arthur A. Hamerschlag, of the New York Trade School, on the "Education of Electrical Apprentices and Journeymen." It was illustrated by lantern slides, showing the work by the electrical and other trade classes at the school. Messrs. Wetzler, Lieb, Thompson and Pope took part in the discussion following. At the meeting of the Executive Committee in the afternoon the following associate members were elected: John Allan, 54 Margaret street, Sydney, N. S. W.; John Jacob Bellman, 90 King street, New York; Robinson Crowell, 72 Washington avenue, Schenectady, N. Y.; Henry B. Dates, Potsdam, N. Y.; John C. Finney, 34 Prospect avenue, Milwaukee, Wis.; William N. Gladson, Fayetteville, Ark.; Leo Walter Hildburgh, 1 West Thirtieth street, New York; William B. Hodge, 707 Spruce street, Philadelphia, Pa.; Saitaro Oi, 16 Kamitomisakacho, Koishikawa, Tokyo, Japan; Francis E. Tyng, Cranford, N. J.; Arthur J. Wood, 162 Washington Park, Brooklyn, N. Y.

BUSINESS NEWS.

CHANGE OF NAME.

The officers, directors and stockholders of the L. J. Wing & Co. have deemed it advisable to adopt a general name for the company, and have legally changed the name from L. J. Wing & Co. to that of Manhattan Machinery Co. There has been no further change, and under the new name the company hopes to merit the continued and increased favors of its many valued customers, as well as such new customers as may be in need of the high grade machinery it manufactures.

BUSINESS CHANGES.

Springfield, O.—The Sprague Electric Co., of Watsessing, N. J., with a capital stock of $5,000,000, has been licensed in Illinois for $2,000.

Baltimore, Md.—Thomas J. Hayward has purchased the franchises, patents, etc., of the Wenstrom Electric Co.

TELEPHONE CALLS.

Waco, Tex.—The Independent Telephone Co. has been incorporated by S. Sawyer, E. N. Stephenson, J. B. Earll and others, to operate telephone and telegraph lines. Capital stock, $75,000.

Lawrence, Kan.—The Kansas-Missouri Telephone Co. is erecting long distance telephone line.

Vinton, Cal.—Vinton Telephone Co. has been incorporated by A. B. Bentley, L. H. Dunning, E. Ramelli, J. Bates and F. Campbell. Capital stock, $20,000.

Fayetteville, Ark.—The North Arkansas Telephone Co. has been incorporated by Millard Berry, James W. Dupree, J. P. Dearer and Walter E. Berry. Capital stock, $25,000.

Nebraska City, Neb.—Nebraska City Telephone Co. has been incorporated by H. A. Cott, C. H. Lanham and H. M. McCurry. Capital stock, $25,000.

STREET RAILWAY NEWS.

Newport News, Va.—The Newport News & Old Point Railway & Electric Co. will construct an entirely new power house for the consolidation of the electric lighting and street railway business.

Pine Bluff, Ark.—Electric power plant for railway will be built. Jeff Hicks, president.

Chicago, Ill.—Citizens' Electrical Railway Co. has been incorporated by R. R. Reynolds and J. G. Latimer, to build and operate a street railway. Capital stock, $10,000.

POSSIBLE INSTALLATIONS.

Tampa, Fla.—The Consumers' Electric Co. will immediately rebuild its dam for water power, recently destroyed by an explosion.

Sedalia, Mo.—W. H. Powell has applied to the city council for franchise to erect and operate electric light plant.

Spartansburg, S. C.—Arch. B. Calvert, Mayor, may be addressed concerning electric light plant.

Athens, Tenn.—W. S. Hoge will establish an electric light plant.

Dallas, Tex.—The Dallas Electric Co. is preparing to make the contemplated $200,000 worth of improvements to its plant.

NEW INCORPORATIONS.

Asbury Park, N. J.—Cuban Electric Co. has been incorporated by William R. S. Melvin, G. K. B. Wade, Herbert A. Howell and others, to manufacture electricity for light, heat and power. Capital stock, $1,000,000.

Portland, Me.—Electric Mining and Reduction Co. has been incorporated by E. K. Milliken, G. D. Burton, Charles Williams, Jr., L. H. Williams and others, to manufacture electrical mining apparatus and do general mining business. Capital stock, $500,000.

Camden, N. J.—Electric Power Development Co. has been incorporated by Marcus B. Taylor, Charles W. Kennedy, Isaac Blum, William Findlay Brown and S. Y. Heebner, to manufacture and supply electricity to municipalities, etc. Capital stock, $500,000.

Louisville, Ky.—The Electric Indicator Co. has been incorporated by C. S. Dawson, D. T. Venderink and J. D. Keene. Capital stock, $30,000.

Richmond, Ky.—The Richmond Electrical Co. has formally organized for the erection of electric lighting plant, as recently noted. Capital stock, $10,000.

Schenectady, N. Y.—South American General Electric Supply Co. has been incorporated by H. W. Darling, S. D. Greene, J. R. Lovejoy, to deal in electrical apparatus. Capital stock, $50,000.

Portland, Me.—Canadian Electrical Process Co. has been incorporated by E. K. Milliken, G. D. Burton, C. H. Kimball and others, to manufacture electrical leather working apparatus. Capital stock, $10,000.

Cheraw, S. C.—The New England Electrical Works has been incorporated by W. E. Price, E. A. Palmer, George T. Nicholls and W. P. Pollock.

Greenville, Miss.—The People's Light Co. has been incorporated by Harley Metcalfe, Fred Metcalfe, George Metcalfe, Lucien C. Gwin, Mary L. Wheatley and George Wheatley. Capital stock, $15,000.

Lakeview, Miss.—The Whitfield Co. has been organized by Marcy L. Whitfield, Jerome Hill, C. C. Cowan, R. B. Snowden and W. A. Percy for the manufacture, sale and operation of electrical appliances. Capital stock not given.

Vicksburg, Miss.—The Vicksburg Electrical Supply Co. has been incorporated by M. I. Mulvihill, S. R. Hughes and M. D. Laudau. Capital stock, $10,000.

NEW YORK ITEMS.

MR. EDGAR PECKHAM, the president of the Peckham Motor Truck & Wheel Co., 26 Cortlandt street, is awaiting the coming of the new year with great pleasure. Through constant and personal attention to business, active and energetic, and versed in all the intricacies of street railway traffic, he has met its never ceasing demands and can say, with Julius Caesar, "Veni, Vidi, Vici." His success has been well earned, and the trade unites in wishing him a happy and prosperous New Year.

THE MANHATTAN MACHINERY CO., 109 Liberty street, L. J. Wing, manager, is the outgrowth of the increasing business of L. J. Wing & Co. Some time ago Mr. Wing built and tested on his auxiliary gas engine yacht an acetylene gas generator, which so successfully met with all the requirements that the outlook for the same for 1899 is very bright. Among the other productions of the Manhattan Machinery Co. are direct connected blowers and fans, isolated electric light plants, gas engines, etc.

THE E. P. GLEASON MANUFACTURING CO., Mercer and Houston streets, found business during 1898 excellent, and all signs points toward prosperity during 1899.

ZIMDARS & HUNT, 127 Fifth avenue, practically opened their department of switches, switch boards, etc., during 1898, and the same has grown to such proportions during this year that the coming year is looked forward to with the greatest confidence.

THE ST. JAMES ELECTRIC CO., St. James Building, manufacturers of a new burglar alarm, are having such a great success with the same that they will find it necessary to increase their output for 1899.

MR. T. E. ÇOPELAND, manager of the electrical department of James S. Barron & Co., has much to congratulate himself upon. This department has been established within the last three years, and the foresight in handling practical specialties in the general supply line has brought the same to the front rank. Messrs. Barron & Co. created a demand for their new pocket torch during 1898, and are now far behind in their orders for the same. They have a very happy New Year to look forward to.

THE VANCE ELECTRIC CO., 136 Liberty street, have had a very prosperous year's business, they having been one of the few successful contractors who fitted out a large number of Government transports during the Hispano-American war. They have no wish for any further war, however, and believe and hope that the coming year will be an excellent one for business.

CHERRY ELECTRIC CO., 25-27 Third avenue, is preparing to enlarge its present factory in order to keep up with the demand for their well-known instruments.

LEONARD F. REQUA, general manager and treasurer of the Safety Insulated Wire & Cable Co., 225-239 West Twenty-eighth street, one of the largest manufacturers of insulated wire, states that business during the past year has been exceptionally good, and predicts that 1899 will be an eventful year.

"PEGAMOID'S" sucess is now an established fact, and the new year can have nothing but good in store for the same, say the manufacturers, the American Pegamoid Co., 346 Broadway. "Pegamoid" aluminum paint is being used by a number of dynamo and motor manufacturers in place of japanning, etc. It leaves a perfect finish, and is not affected by acids, water, etc. The "Pegamoid" lacquer for applying to the bright parts of machinery, electrical apparatus, etc., is proof against rust, etc., and is meeting with great success among the manufacturers of the above goods.

The Electrical Age.

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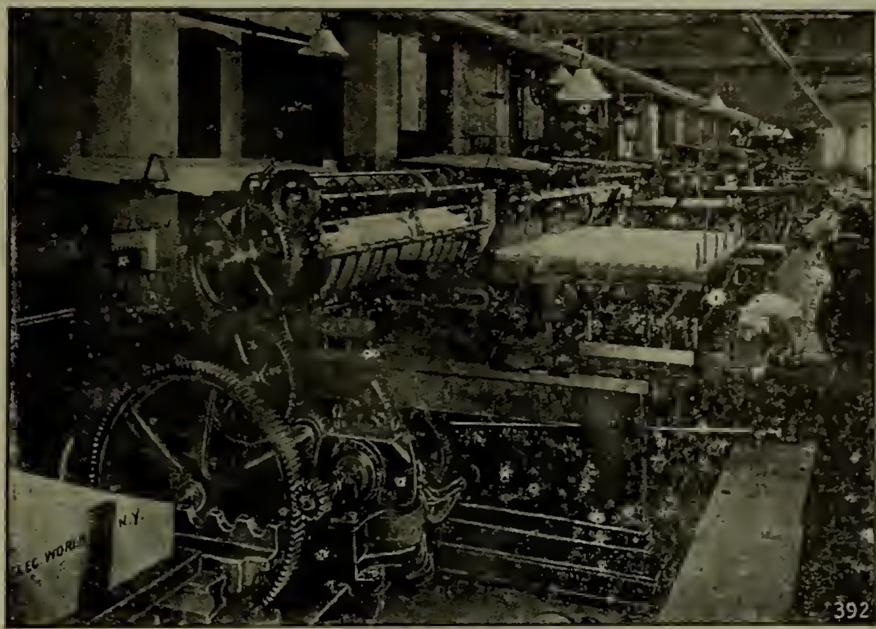
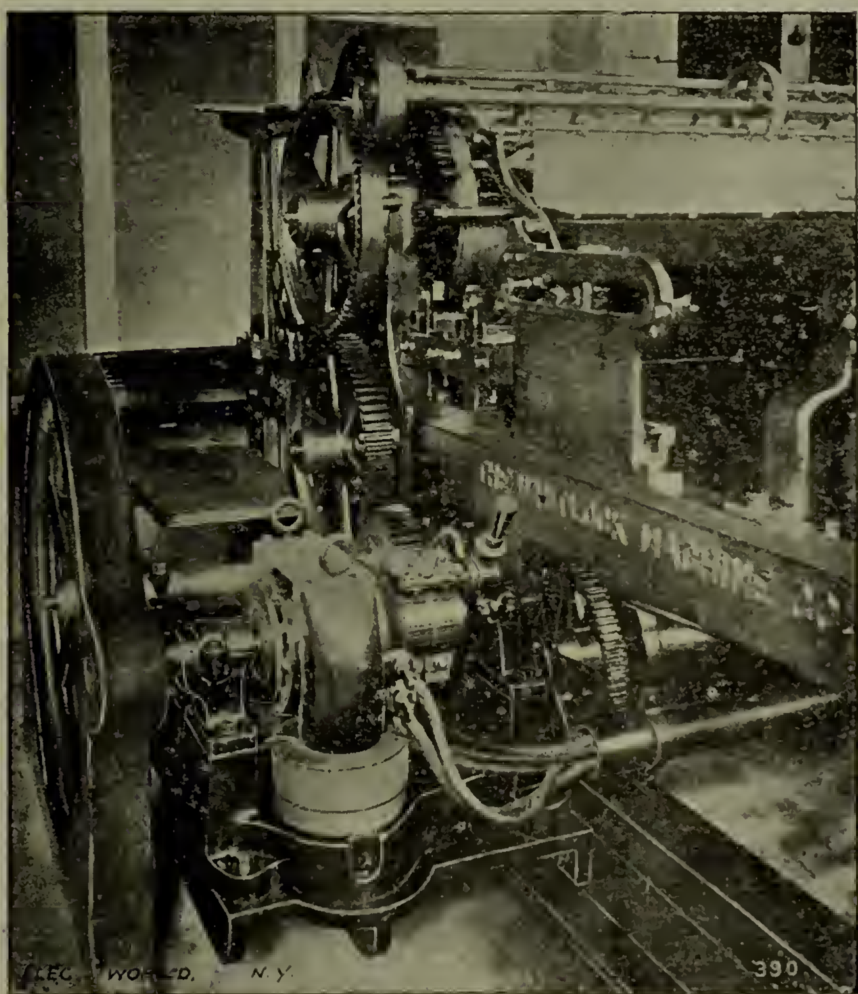
ELECTRIC LIGHT AND POWER.



Press Room in New Building of Government Printing Office.

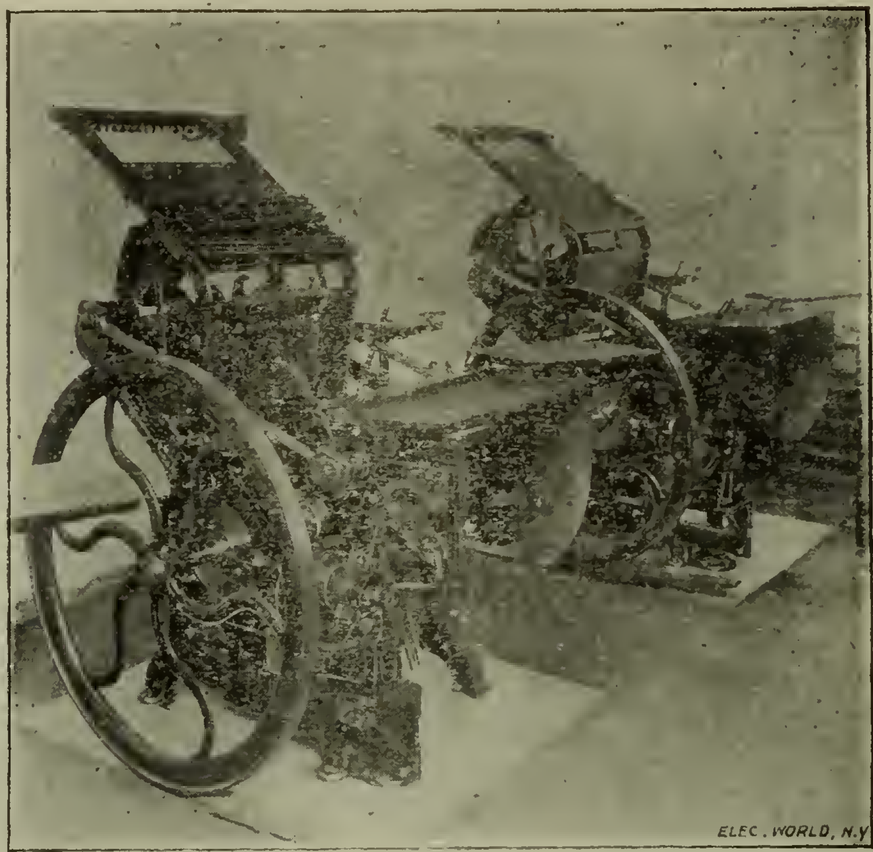


C.-W. Motor Geared to Whitlock Press.

ELECTRIC PRINTING PRESSES.

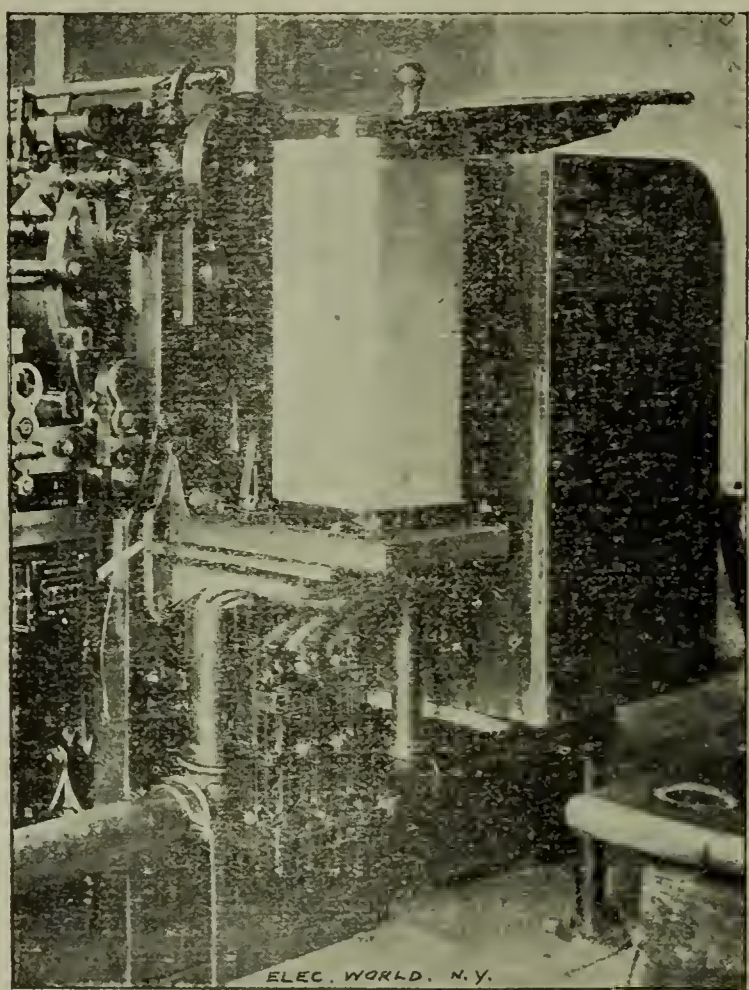
Motors for operating printing presses have come so largely into use, and the combination has been so successful that there in every likelihood of electric presses becoming universal in the printers' world. With the increasing demands of civilization for more literature, with a growing daily appetite for more news, presses to meet this exigency are built of colossal proportions. The great papers of the United States, including the "Herald," "World," "Journal," "Times" and "Tribune," are taking a practical interest in the improvements suggested by electrical engineers in presses. The belt driving of large presses is no longer practical in great printing houses. It is expensive and risky where fifty or a hundred thousand papers an hour may be re-

quired. A broken belt, moreover, might do more injury to the press in five seconds, if it accidentally broke loose, than the greatest accident that could possibly happen to any other power driving device. Each press becomes a unit in itself when driven by a motor. The entire system is not dependent upon one machine. There is little or no loss of power before driving



C. W. Motors on Gordon Presses.

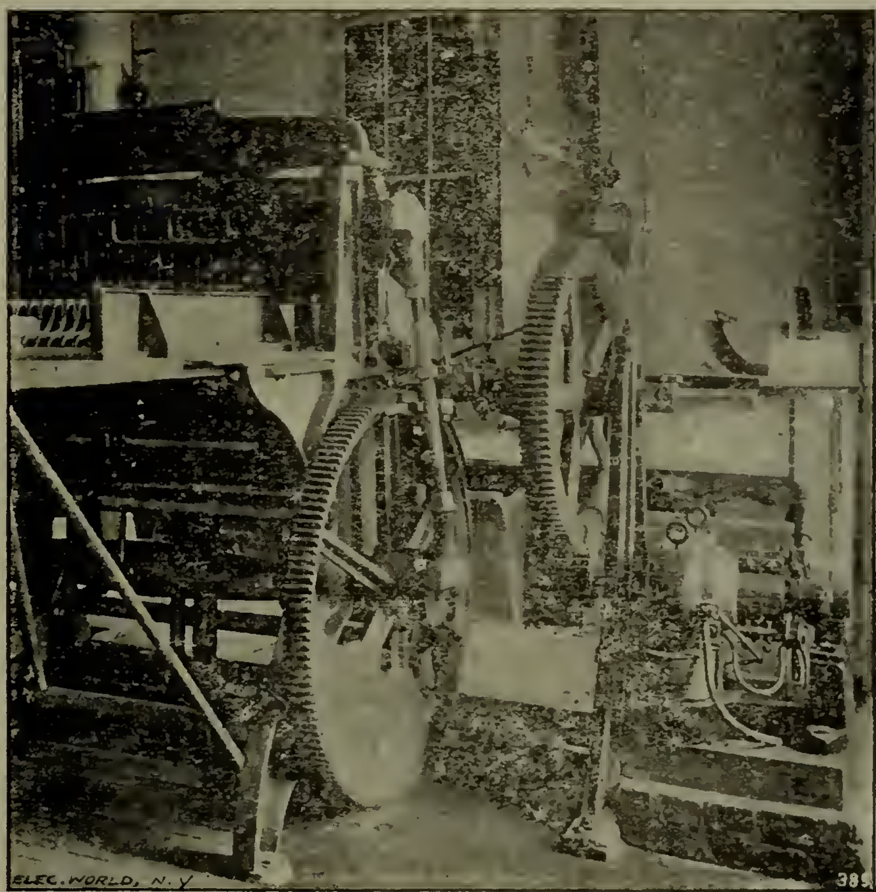
the press, and the absolute control exercised by having presses electrically equipped is simply ideal. From a technical standpoint a great cylinder press, or those of more complex construction, such as color presses, find their greatest load at the moment of starting. To overcome this inertia, the motor, like that used on a car, must be capable of resisting the severe shock experi-



Method of Attaching Controller and Resistance to Whitlock Press.

enced at the moment of starting. The Crocker-Wheeler motors, illustrated in these pages, in direct connection with Gordon, Whitlock and other presses, have been extremely satisfactory to some of the largest printing concerns in the country. The percentage of overload and high efficiency of these motors insures for them a long life of active operation. The press room in the

new building of the Government Printing Office contains a series of electrically driven presses. Twelve Crocker-Wheeler motors, each direct connected, drive this large plant, and since its installation little or no attention has been required by the employees in charge. For small Gordon presses, direct connected motors occupy a position above competition. The easy starting and stopping of the press, the compactness of the machine as a whole, and the increased satisfaction to the man operating it all combine to give better and quicker work. There is, therefore, in the direct connection of motors to presses another element of profit which must receive consideration. It depends, of course, upon the personal equation. The more modern a machine, as a rule, the more quickly it is supposed to perform its functions. A man in charge, therefore, understanding this, will make more effort to do work and produce results than he would otherwise. Were Gordon presses supplied with self-feeding apparatus and personal attention thereby eliminated, competition between them and those run by ordinary methods would be impossible. It has been shown that the loss in shops through belting and shafting amounts to at least 40 per cent. of the power generated. With presses driven by electricity 10 or 20 per cent. at the utmost would cover the total loss. If power cost $2,000 a year, and 20 per cent. is saved, $400 dollars per annum would be pocketed by the investor. Adding this to the value of the time saved and the facility with which work is done, a large printing house could readily save $1,000 a year or more by using electric power as outlined above.



C.-W. Motor Geared to Brown & Carver Cutter.

MISCELLANEOUS SCIENCE.

STRAY CURRENTS.

Exclusive of sleeping cars, there are 1,350,000 cars running on railroads in the United States. It is estimated that 100,000 of these go out of service yearly.

The disinfectant recommended by Kronig and Paul in the Philadelphia polyclinic, discovered in the course of their painstaking tests of various disinfectants by the light of the new physicochemical theories of solutions and electrolytic dissociations, is a mixture of potassium permanganate and hydrochloric acid. This solution kills the most resistant spores from extremely virulent anthrax bacilli in a few minutes, while it is cheap, nontoxic, convenient and fully equal to a 5 per cent. solution of sublimate.

Osmium threads for incandescent electric lamps, giving a very brilliant, have been patented in Germany. The threads are hollow, the osmium being coated upon a thin copper wire, which is evaporated at a high temperature.

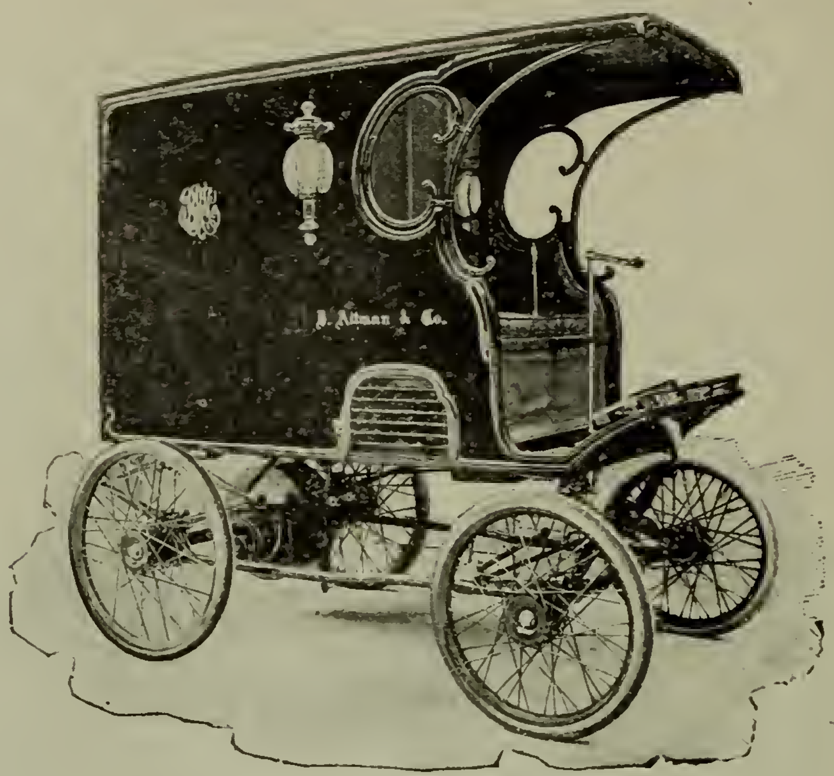
The United States Civil Service Commission announces that it is desired to establish an eligible register from which a selection may be made to fill an existing vacancy in the grade of assistant engineer, electrically qualified, at a salary of $1,000 per annum, in the custodian service at Baltimore, Md. Eligibility for appointment will be determined from an examination into each applicant's experience, ability and character as a workman, and physical qualifications for the work to be performed.

The "Herald" of the City of Meixco says that "all over this country water powers, within reasonable distance of centers of population, are being sought for, and, although the best informed people do not believe there are many of them, still there are enough to prove of great utility in prompting manufacturing enterprises in this land of dear fuel. As is well known, President Diaz has given much consideration to this matter, and he has, in several instances, greatly aided enterprising people who had discovered powers and were in peril of being deprived of the results of their labors by unprincipled persons who stood ready to levy tribute on their undertakings. It is to the credit of the president that he does not allow the blackmailing of men of enterprise and energy. The transmission of power by wire over long distances is receiving, in this country, the enlightened encouragement of the Government."

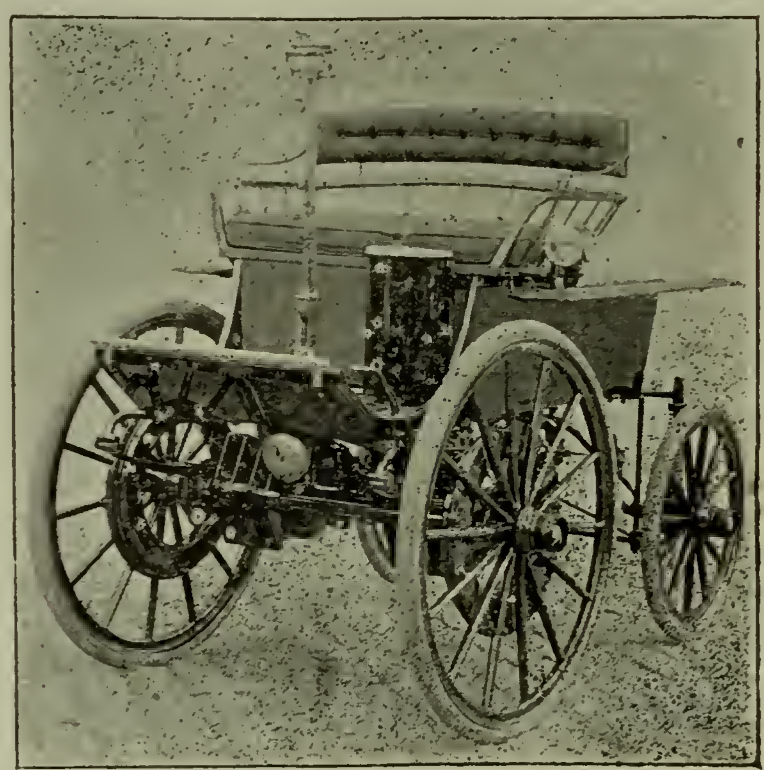
AUTOMOBILES.

ELECTRIC VEHICLES.

Greater New York is not wasting any time in appreciating the progress made by European cities in automobiles, both as regards their construction and use. Not only have New Yorkers decided to adopt the electric carriage as a necessary adjunct of civilization, but in addition a company has been organized for the purpose of manufacturing and probably renting express wagons and trucks moved by either electricity or gasolene. One of the greatest difficulties with electric carriages at present is the unreliability of the storage battery. Of course, the item of waste is ever present, and in this respect the gasolene or naphtha automobiles are superior. They are, however, far behind in cleanliness and way ahead in danger and personal risk to the operator. Greater New York is fairly level, but a margin of power will have to be allowed for on account of some slight ascents in certain parts of New York proper. The horse power required to propel a vehicle depends upon the tons moved, the inertia to be overcome and the speed, in feet, per minute. In fact, the margin of power spoken of will depend largely upon the line of the angle of inclination at any given locality. This quantity, of course, would be added going up hill, and more than subtracted when going down. For vehicles running on rails the pounds pull required to start them would be about twenty pounds for raised rails and from twenty-five to fifty pounds for sunken rails. With vehicles moving on cobble stones or asphalt, this is not much greater, and, in fact, with rubber tires, is very much less. An ordinary cab will use about five horse power, a heavy truck would require from ten to fifteen. If there were more asphalt streets in New York electric cab interests would certainly increase, with direct benefits to the general public.



Riker Electric Delivery Wagon.



Automobile of the Electric Carriage and Wagon Company.

The Electrical Age.

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CONTENTS: PAGE.

IS LIGHT ELECTRO MAGNETIC?

Men of science are given to idealism. There is a certain poetic side to scientific conceptions, which tempts the savant to deal with the prosaic and purely material in an abstract and occasionally incomprehensive manner.

The theories of Darwin regarding the evolution of man, the masterly efforts of Herbert Spencer and the shaded opinions of other minor scientists have been received as vagaries, unsubstantial and unproven. But as theories are unfolded in all their perfection, and as proof upon proof is produced, which leads the minds along the paths of truth, then what has seemed to be but a theory becomes a fact, and the originator of it a renowned character.

While the field of science has broadened the specialism that has resulted makes it relatively narrower for the individual. New fields of research merely represent new centers from which radiate a dozen or more sub-departments. The crystallization of a simple principle of use to mankind has inevitably resulted in this consequence.

From the rude invention of Watt has resulted innumerable types of steam engines. Their appearance has called into being a myriad of accessories. Varieties of boilers have been invented and each new change has invited a rapid increase in new devices.

In the study of electricity the greatest name was earned by Faraday. Not only were his efforts productive in a purely practical and commercial sense, but in the higher realms of science, where reason can faintly guide the images, half formed by a series of inspiring experiment, to the goal of perfect comprehension.

As a practical experimenter, few, indeed, have kept pace with the genius of Faraday, and the mathematical elaborations of Clerk Maxwell, and even Hertz, are but extended interpretations of Faraday's far-reaching ideals.

Considerations regarding the ether have largely to do with the suppositions that follow regarding the nature of light. "The ether is supposed to be homogeneous, and of the same density and rigidity in all bodies, and that when light enters a transparent medium the molecules of that medium may be set in motion isochronously with the motion of ether."

This brings us to the question which seems to be one of daily and growing interest, is light electro magnetic? Does the sun send through the ether bridge between itself and us an influence through which electromagnetic energy operates and produces undulations in the ether which we call light?

The subject is so strange and the conclusions that might be drawn from a consideration of it so remarkable that it would probably stir the scientific world to its very core to hear an absolute statement in regard to the true nature of light.

"The luminosity of a body is due to an infinitely rapid vibratory motion of its molecules, which, when communicated to the ether is propagated in all directions in the form of spherical waves, and this vibratory motion, being thus transmitted to the retina, calls forth the sensation of vision."

This definition has been given by the highest of authorities, but there is every reason to suppose that in the light of scientific research and the tremendous efforts that are being made to discover the truth, the definition of light will be framed by the electrician and not the general physicist.

Our ignorance of the true nature of actions in the ether prevent us from comprehending the meaning of many phenomena. If the ether is an electro-magnetic medium, then the following would be a magnificent prophecy. "We can, without hesitation, predict that the ideas which have thus guided to so much discovery are destined yet to be the clue to conduct to further revelations of the nature of the unseen mechanism, which lies behind the apparent operations on or behavior of the bodies in the electro-magnetic field, and of which these actions are the result.

"If the nature of that machinery, as yet shrouded in darkness, should prove to be capable of more entire elucidation by some vortex motion theory, not only explaining the structure of matter itself, but the inmost action of the electro-magnetic medium, then the sciences of electricity, magnetism, optics, electro-chemistry and rediation will become only departments of one embracing science of hydrodynamics, while we shall yet find ourselves in the presence of still more surpassingly complex puzzles as to the nature of energy itself and its relation to the physical structure of the electro-magnetic medium."

The processes of transformation carried on in an electric light plant are those in which the same doll is simply given a series of new dresses.

"Consider, for instance, the simple case of an alternating current dynamo, connected to an incandescent lamp, by conducting leads. We have in this case a closed conducting loop, consisting partly of the armature wire, partly of the leads and lastly of the lamp filament. The action of the dynamo, when at work, in alternately inserting into and withdrawing a bundle of lines of magnetic induction from a portion of this enclosed area or loop. The insertion of these lines of force causes an electro-magnetic disturbance, which travels away through the enclosed dielectric in the form of some strain or displacement in its most generalized sense.

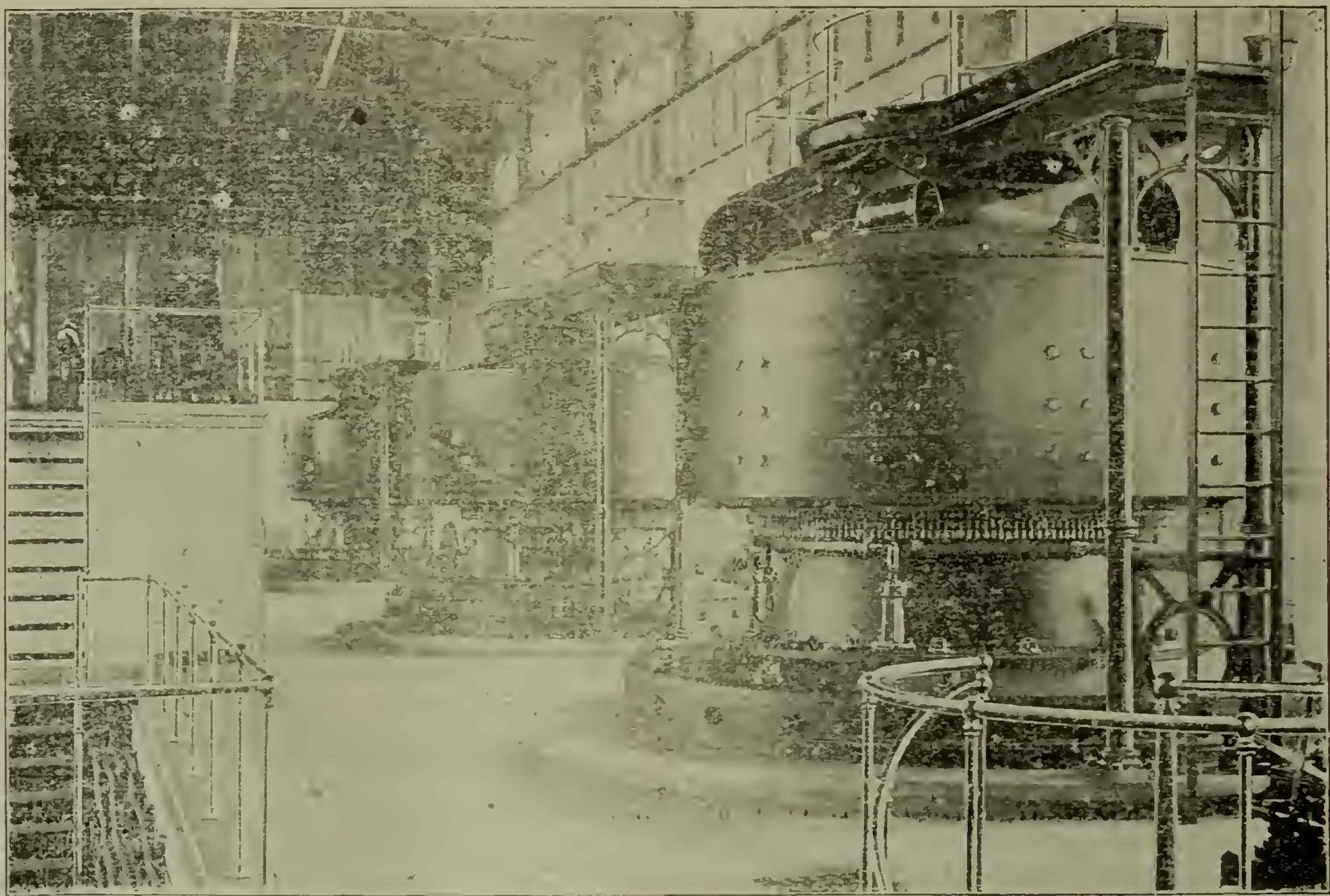
"In reaching the surface of the enclosing conductor, this wave begins to soak into it, the electro-magnetic energy at the same time dissipating itself in the form of heat. By a suitable arrangement of the resistances and surfaces of various portions of the circuit we are liable to localize the principal place of transformation and to control its rate so as to compel this transformation of energy to take place at a certain rate in a limited portion of the conductor.

"Energy is then sent out, thence again in a radiant form, partly in the form of ether waves, capable of exciting the retina of the eye, but largely in the form of dark heat. The ether of electro-magnetic medium is, therefore, the vehicle by which the energy is carried to the lamp and conveyed away from it in an altered form, and whatever, by the translating device employed, the ether is the seat of the hidden operations, which are really the fundamental ones, and the visible apparatus only the contrivance by which the nature of the energy transformation is determined and its place defined."

POWER TRANSMISSION.

WATER POWER PLANTS.

Some facts may be noted below in relation to water power plants which will outline their principles of operation, general efficiency, etc. Under the head of water power plants power transmission plants are also included. Water wheels and water motors for electric lighting have come so greatly into vogue the last five years that we cannot help recognizing their extreme importance and value commercially. Considerable water power is wasted in the United States. To this may be added the statement that a lot of money is wasted in water power. Money that could have been better invested in steam plants becomes unproductive and a source of constant expense in many cases. This mistake is directly traceable to the hurried installation of a water power plant, in cases where it does not pay and cannot pay to depend upon it. The first point to discover is the reliability of the supply, and then to estimate the average horse power during the year. A cubic foot of water weighs sixty-two and one-half pounds, consequently the number of cubic feet per minute multi-



Turbine-Driven Generators of the Niagara Falls Power Co.

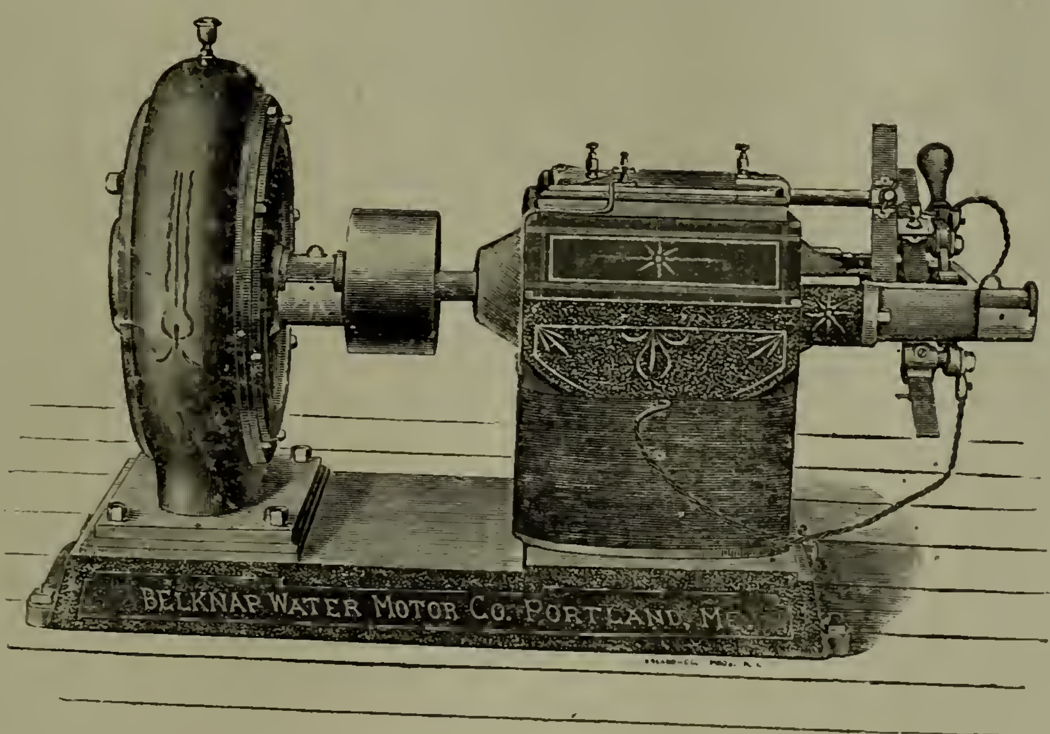
Transmission Line, "Virginius" Mine, Rising Up the Mountain Side.

plied by the head in feet gives the foot pounds. Dividing this quantity by thirty-three thousand gives the horse power. The entire formula will read:

Horse power equals sixty-two and one-half multiplied by cubic feet, multiplied by head, the whole divided by thirty-three thousand. The technical expression "miners' inch" compares very well with the lectric unit, the ampere. Dr. T. O'Connor Sloane speaks of it as follows: "For the ampere a peculiarly close analogy is found in a very well-known water measurement unit, namely the miners' inch. The miners' inch is defined as the quantity of water which will flow through an aperture an inch square in a board two inches thick, under a head of water of six inches. Here, as in the case of the ampere, we have no reference to any abstract quantity, such as gallons or pounds. There is no reference to time. It is simply and purely a rate of flow, exactly what the ampere is conceived to be in electricity."

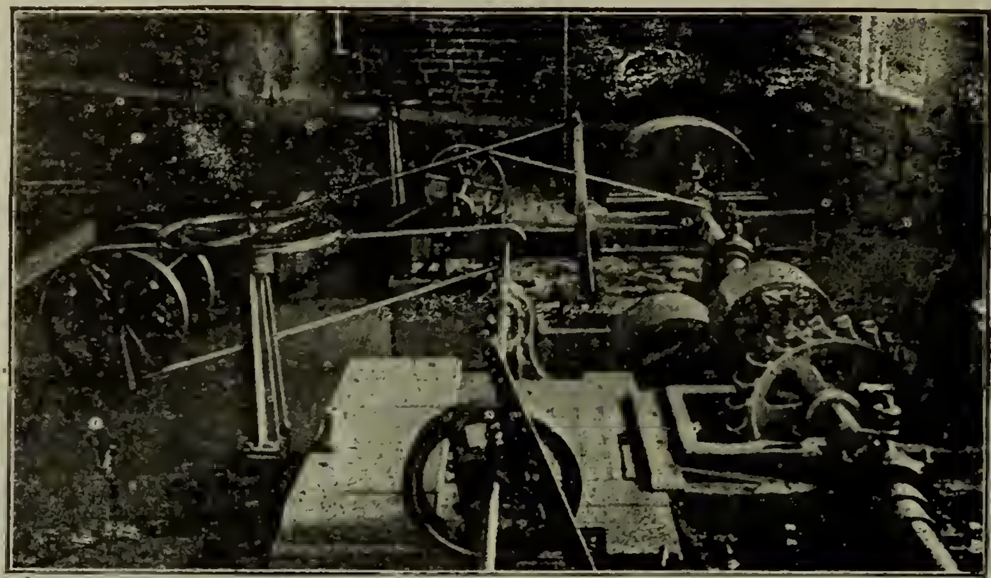
A dam placed across a stream will enable an estimate to be made of the quantity of water flowing a minute. Waterwheel catalogues contain tables by means of which the correct value of the power obtained from this quantity of water and the size of wheel suited to it may be discovered. The average depth of the stream and its width will give the cross sectional area. Multiplying this by the rate of flow per minute, determined by the use of floats placed in mid-stream, will give the number of cubic feet of water passing per minute. The formula previously given is, of course, here applicable for giving horse power. With water-wheels having an average efficiency of 80 per cent. and dynamos direct connected from 70 to 75 per cent. of the energy of moving water can be utilized. Illustrations of power transmission lines and water power plants will give the reader an idea of some of the labor connected with their proper installation. The general efficiency of a transmission plant whose source of power is water, would figure out something like the following: About 75 per cent. of the initial energy is transformed into electricity; 10 per cent. of this is lost in the line, leaving $67\frac{1}{2}$ per cent. At the other end another 10 per cent. is lost in the motor, giving a

The "Virginius" Silver Mine in Colorado, operated by Electricity, which travels through the Power Line, 12,000 Feet above the Sea Level.

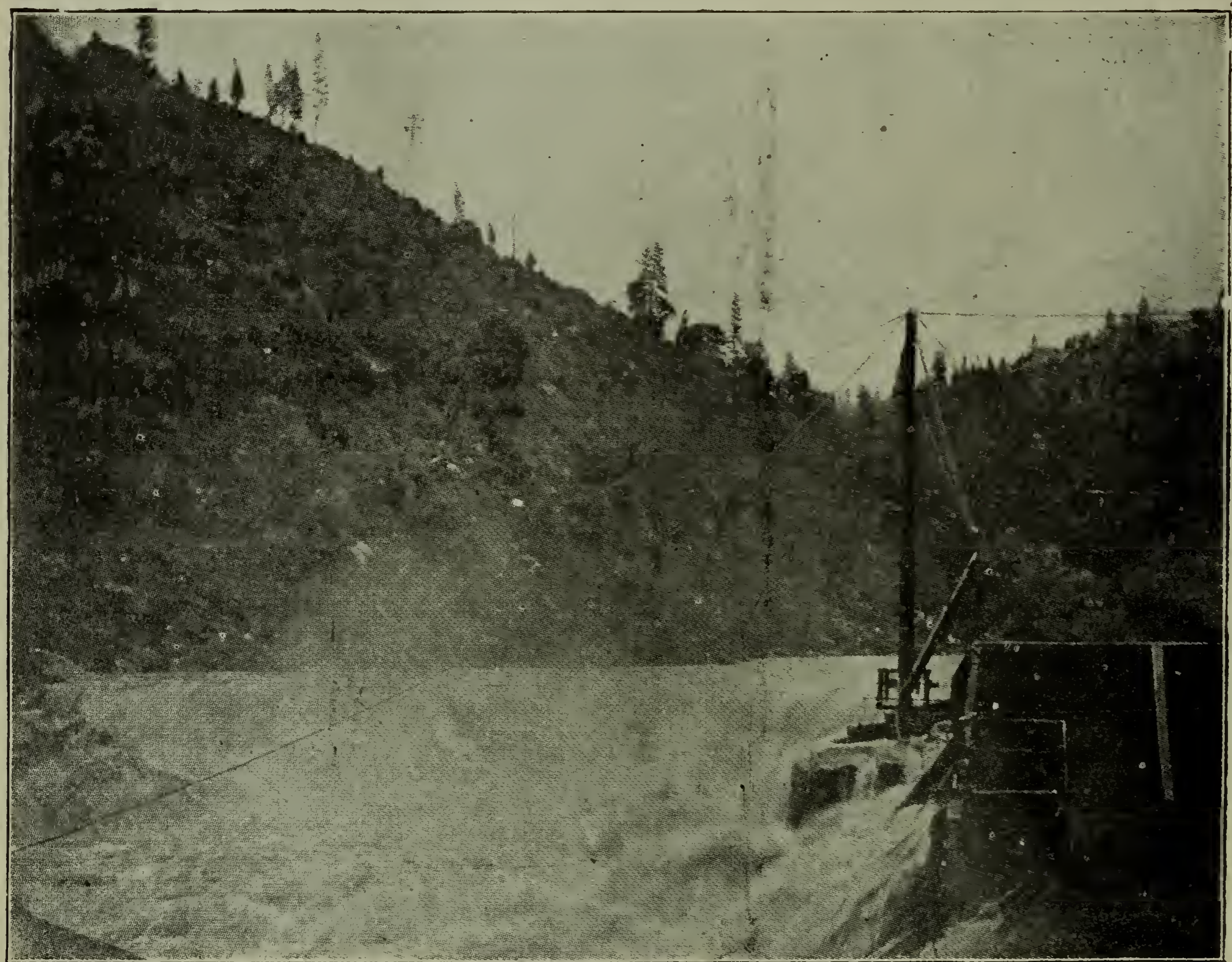


Water Motor Driving Generator.

general efficiency over all of about 60 per cent. Commercially speaking, the cost of a water power installation is more than of a steam plant. But, if the stream is apt to be frozen in winter and an auxiliary steam plant is required, the investment becomes disproportionately heavy. The percentage of profit on such an investment would be much less than expected, and would favor the purchaser only in summer, when the water ran freely. The cost of the water power installation, outside the building of the dam, would include that of the waterwheel, or turbine, the generators, the building they are contained in, with its accessories, the line and possibly motor transformers at the receiving end. Dividing the horse power generated into the original cost will give

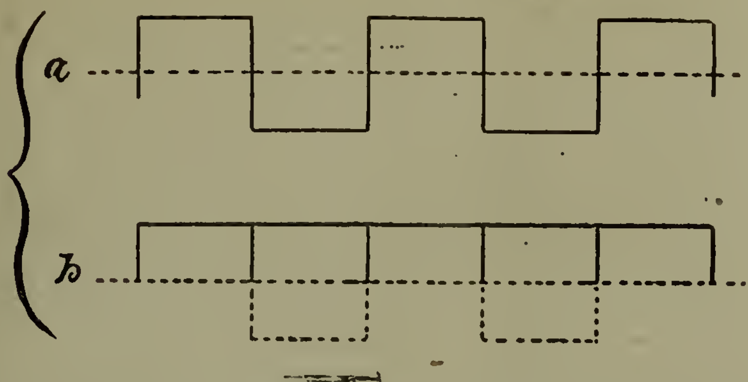


Water-Power Plant Driven by Pelton Wheel. Fall of Water 250 Feet.



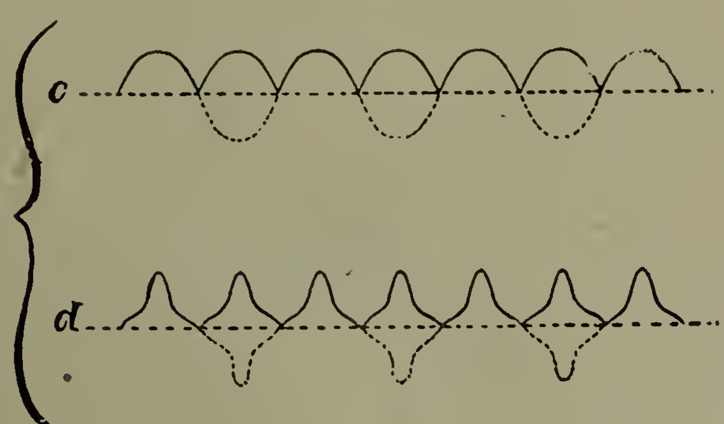
Electric Water-Power Plant on South Yuba River, California.
(Erected by Hasson & Hunt.)

the figures per horse power, or installation alone. Dividing the horse power generated into the expense of operation per annum will give the cost of a horse power for a year. As the



Alternating Current Transformed, or Rectified into Direct Current.

prosperity of a plant depends upon the sale of its power and the price obtained for the same, these calculations are necessary before the plant is installed. They may possibly prove to be so high that a steam plant operating throughout the year is preferable.

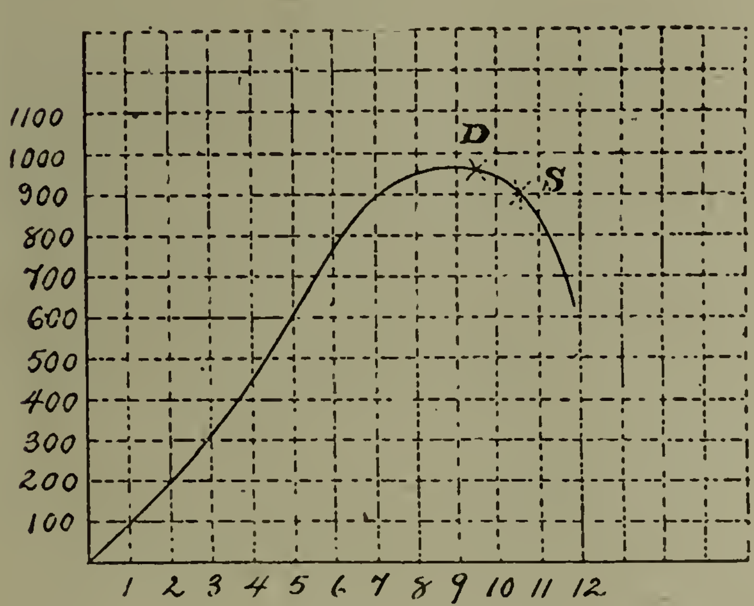


Direct Current Impulses.

ELECTRO-TECHNICS.

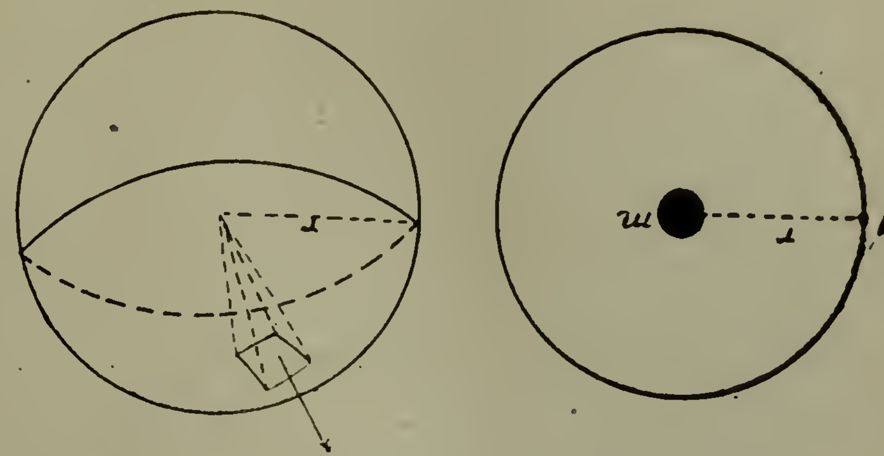
SOME ELECTRO TECHNICAL NOTES.

Arc light and alternating current generators represent two of



Characteristic Curve of Arc Light Machine.

the oldest types of electrical machinery in existence. The average high tension arc light machine and alternator vary in pressure from one to two thousand volts. The difference between them technically is in certain respects inconsequential. The sketches show the easy transformation of an alternating current into a continuous, as well as the peculiar shape of the impulse

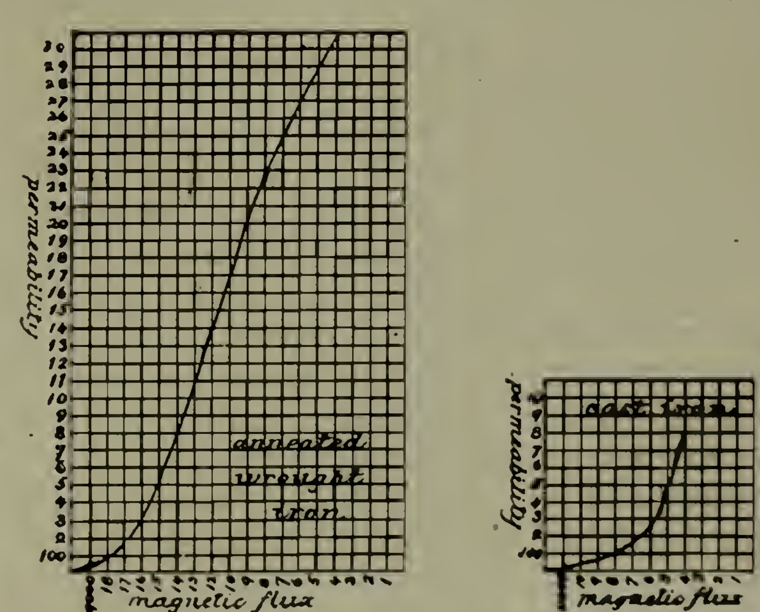


Theory of the Line of Force.

proceeding from arc-light machines. The fluctuating pressure and throb of the current are ever noticeable features. By placing every alternate wave above the line an alternating current becomes a direct current suitable for arc lighting. Commutation easily effects this without any great technical difficulty. If

Reaction of Two Coils.

an ordinary continuous current dynamo has two insulated collector rings placed upon its commutator, each ring respectively connected with diametrically opposite segments, the dynamo will



Curve of Saturation of Wrought and Cast Iron.

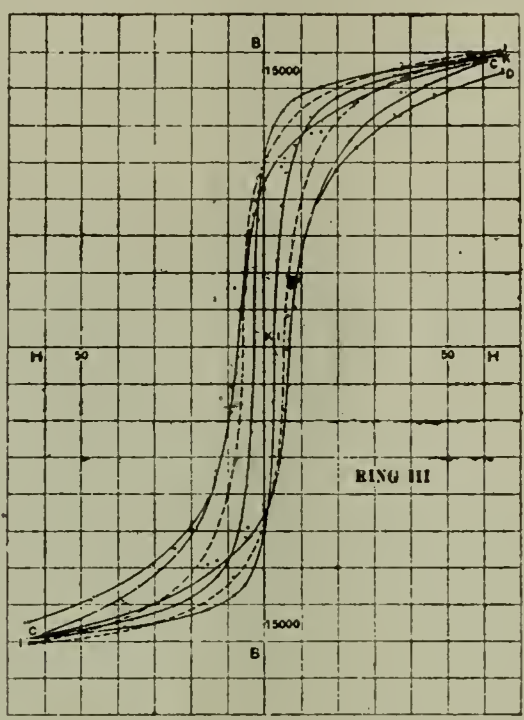
give an alternating current of the frequency and pressure the number of poles would lead us to expect.

In experimental lectures an audience has frequently been

astonished at the repulsion exhibited by two flat coils carrying the same current and suspended so as to be able to swing together and apart. A good rule for remembering the polarity of the end of a coil is to recollect that if the current flows in the direction of the hands of a clock in the end facing you polarity is south. The reserve direction means an opposite polarity.

A line of force owes its origin to a consideration of what is called a unit pole. This is a magnetic pole, which will attract or repel a similar and equal pole with a force of one dyne at a distance of one centimeter. This unit pole produces about thirteen lines of force. Consequently, in all calculations for lines of force the unit pole is taken into consideration. It was necessary to adopt some fixed quantity of magnetic force as a means of measuring it. Otherwise, the science of magnetic measurement would have been so indefinite as to have prevented, or, at least, retarded the rate of progress now being made in electrical manufacture.

In winding the coils of generators it is necessary to make



Hysterisis Curves.

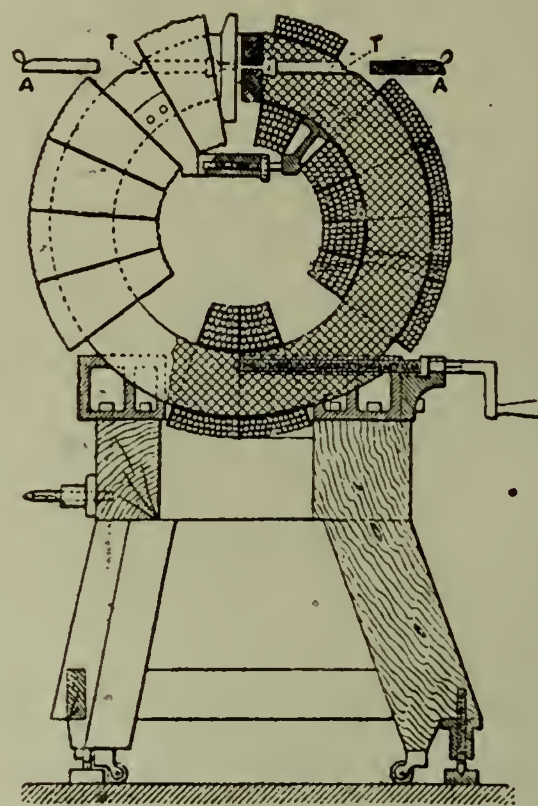
provision for the heat loss so as to dissipate it readily. The depth of winding will have largely to do with the radiating surface and the quantity of copper used. For instance, taking the center circle of the illustration as one inch in diameter, and of the successive concentric circles, two, three and four inches, the various radiating surfaces of coils wound would be in proportion to their diameter. It is usual to allow one thousand circular mils per ampere in the winding of a field coil. But another way is to vary the circular mils according to the weight of copper when a given amount of energy is to be consumed. By varying the depth of winding the quantity of copper increases. The temperature of the copper depends upon its weight and the amount of energy it dissipates. One coil having more copper on it than another dissipating the same amount of heat would run cooler. Consequently, a coil two inches in diameter, wasting a hundred watts, would rise to a higher temperature than a coil three inches in diameter wasting the same amount of power. A coil can always be designed to run cool, provided it is not wound too deeply nor given too much energy to utilize.

In alternators the power lost through hysteresis is quite an important factor. The machine invented for testing iron before it is used enables a manufacturer to estimate beforehand such losses. Hysteresis losses, due to molecular friction, so to speak, were dilated upon thoroughly by Steinmetz. In transformer construction and every department of alternating current work they are ever present. About 1 per cent. of the power of an ordinary continuous current generator is wasted by hysteresis. At least 5 per cent. disappears through this cause in alternators.

TELEPHONIC.

A NEW FRENCH TELEPHONE.

According to "La Vie Scientifique," the French Minister of Commerce has been conducting experiments with a new telephone invented by Pierre Germain, an inspector of telegraphs in Paris. In order to secure patent rights the inventor has withheld all information regarding the mechanical construction of his telephone. From the little that can be gleaned from the first experiments made, it would seem that the telephone was capable of reproducing sounds with greatly increasing phonic power, but with a loss in clearness. In the experiments the receiver



Device for Producing Intense Magnetic Fields.

having been brought closer to the ear, not a single intelligible word could be heard; but the greater the distance between the receiver and the ear, the clearer was the sound reproduced. The first defect, it is said, has been remedied. When the experiments were made with this instrument, men and women walking in the streets, although more than 100 yards distant from the receiver, would stop and stare, wondering whence came the voice of superhuman power which they heard above the din of the street. So powerful is this instrument, that, when used in connection with a phonograph, it is capable of emitting audible sound waves to a distance of nearly 2,000 feet.

ELECTRO-METALLURGY.

ELECTROPLATING ON WOOD.

If a simple method of coating wood electrically with metallic deposits of silver or copper could be devised, there should be a considerable demand for such articles for ornamental parts of various articles of furniture, mouldings, picture frames, etc. Mr. C. F. Barnes describes, in the "Electrical World," a method which, he believes, will meet the requirements. The operation is briefly as follows: The wooden article is first saturated with

copper sulphate by immersing it in a solution of that substance; then removed and thoroughly dried. It is then exposed to the action of hydrogen sulphide gas, which converts the sulphate of copper to the sulphide—which is a conductor of electricity, and also insoluble in aqueous solutions. Then the article is lightly wrapped with fine copper wire, and suspended in a solution of common salt at the cathode, and a current of some density is passed. The copper sulphide is thereby speedily reduced to metallic copper, by the reducing action of the cathode products. When the reduction is supposed to be completed, say in ten minutes, the article is transferred to an ordinary copper-plating bath, where a coating of copper of any desired thickness may be formed upon the surface. The copper surface may be polished or varnished, and is very adherent. For silver, the process is modified by immersing the object, after preliminary coppering, in the silver-plating bath.

A method of depositing metals direct from the ore has been tried for some time in Germany, and has proved so successful that a number of metallurgical works are to be equipped for this process by treating the ore. The copper ores (as the process has been used most for refining this metal) are first ground to a fine powder and then leached in a hot solution of copper chloride, the effect of which is to dissolve the copper, silver, lead and nickel, and change the solution to cuprous chloride. By the action of lime the arsenic, bismuth, antimony and iron are eliminated, and the solution, after being filtered, is passed into receptacle divided by a diaphragm. Here an electrolytic action occurs. The anode being carbon and the cathode copper, the copper of the solution is deposited in the cathode chamber, while the chlorine set free in the anode chamber combines with the solution to form cupric chloride, which serves to dissolve more of the copper ore. There is no loss of the solution, as the action is continuous. It is claimed for the process that the yield nickel are also obtained in a free state.

BUSINESS NEWS.

SPECIAL EXPORT COLUMN.

TOTAL ELECTRICAL EXPORTS FOR WEEK ENDING JAN. 3, 1899, $28,618.

New York, N. Y., Jan. 3, 1899.—The following exports of electrical material from the port of New York for the week ending this date:

Antwerp.—Forty-six packages electrical material, $2,849; 1 case electros, $11.

Brazil.—Eight cases electrical material, $341.

Cuba.—Eighty-four cases electrical material, $2,292.

Copenhagen.—One case electrical material, $36; 4 cases electrical machinery, $800.

Ecuador.—Ten packages electrical material, $76.

Hamburg.—One hundred and one cases electrical material, $7,359.

Havre.—One hundred and four cases electrical material, $4,537; 3 cases electric motors, $1,300; 9 cases electrical machinery, $241.

Hayti.—One case electrical material, $45.

London.—One case electros, $22; 56 cases electrical material, $2,500; 1 case electros, $22.

Liverpool.—Forty-one packages electrical material, $1,726.

Mexico.—Twenty-seven cases electrical material, $705.

Newfoundland.—One package electrical material, $10.

Newcastle.—Twelve cases electrical material, $1,000.

Nova Scotia.—Eighty packages electrical material, $53.

Peru.—Five cases electrical material, $77.

Porto Rico.—Three packages electrical material, $22.

Rotterdam.—One case electros, $25; 1 case electrical material, $141.

Rome.—One case electrical material, $75.

Southampton.—Thirty-five cases electrical machinery, $782; 37 cases electrical material, $1,424.

United States of Colombia.—Four cases electrical material, $120; 1 case electros, $18.

TELEPHONE CALLS.

Carbondale, Pa.—The Carbondale Telephone Co. has been incorporated by J. Moses, M. F. Norton, S. S. Jones, F. Remmelmeyer, F. E. Dennis and W. D. Evans. Capital stock, $5,000.

Woodstock, Ill.—Citizens' Telephone Co. has been incorporated by M. L. Joslyn, J. C. Donnelly, and D. F. Curley. Capital stock, $20,000.

Ashland, Ohio.—The Star Telephone Co. has been incorporated by George A. Williams, E. J. Grosscup, Samuel A. Grabill, Joseph R. Swartz and George R. Freer, to build and operate a telephone line in twenty-four counties. Capital stock, $50,000.

Springfield, Ohio.—The Home City Telephone Co. has been incorporated by I. Ward Frey, Charles H. Prince, Robert C. Gotwald, Edward C. Gloyn and Robert R. Mills, to build and operate a telephone line in Springfield and Clarke counties. Capital stock, $75,000.

Ansonia, Conn.—The Ansonia Telephone Co. has increased its capital stock from $10,000 to $15,000, all of which has been taken by the old stockholders.

Columbus, Ga.—The Southern Bell Telephone & Telegraph Co. will overhaul and improve its system extensively.

Opal, Wyom.—The Opal and Big Piney Telephone Co., incorporated by A. Pomeroy, C. W. Holden, C. F. Robinson, D. B. Budd and others. Capital stock, $5,000.

NEW INCORPORATIONS.

Trenton, N. J.—The Electric Co. of America, incorporated by James E. Hayes, Elmer Smalling and Arthur Phillips; electricity, light, etc. Capital stock, $25,000,000.

Minneapolis, Minn.—The Gugler Electric Manufacturing Co. has been incorporated by J. H. Gugler, S. T. Wiedenbeck and J. J. Heinrich, to manufacture electro-medical apparatus. Capital stock, $20,000.

St. Louis, Mo.—Frank Adam Electric Co. has been incorporated by Frank Adam, Fred B. Adam and L. M. Adam, to manufacture electrical appliances. Capital stock, $25,000.

St. Louis, Mo.—Gould Electric Protective Co. has been incorporated by H. V. P. Cocke, Allen T. West, Oscar H. Vieths, W. F. Noeker, James T. Drummond and A. B. Gould; general burglar alarm, electric signal and messenger service.

Newark, N. J.—C. P. Power Co. has been incorporated by Fred W. Yates, Frank W. Roller, George E. Snider, to manufacture electricity, etc. Capital, $200,000.

Chicago, Ill.—B. Allen Co. has been incorporated by J. B. Allen, W. R. Heath and C. C. Carnahan, to manufacture electrical apparatus. Capital stock, $2,500.

Dayton, Ohio.—The Automatic Switchboard Co. has been incorporated by W. M. Bell, C. Whitney, W. M. Weakley, W. L. Blecher and L. C. Walker, to manufacture and sell automatic telephone switch boards. Capital stock, $10,000.

JOTTINGS.

THE NEW YORK SWITCH AND CROSSING CO., of Hoboken, N. J., are filing a large number of orders for their new electric switch for trolley roads, and also a large order for

frogs and crossings for the Brooklyn trolley roads. The company has lately added a number of heavy machine tools and planers for cutting steel rails to their factory equipment.

MESSRS. H. W. M'CANDLESS AND F. D. L. PRENTISS, of the Empire Lamp Works, 151 Monticello avenue, Jersey City, N. J., have dissolved partnership. Mr. McCandless continuing the business, which is in a very flourishing condition. Mr. Prentiss' larger outside interests demanded his undivided attention, and he was, therefore, obliged to make a change.

J. H. WILLIAMS & SON, Jersey City, N. J., manufacturers of roll dropped commutator segments, fuse wire, cast gongs and electrical specialties, are receiving a good share of electrical business.

THE U. S. BATTERY CO., formerly cf West Twenty-third street, New York City, have removed their offices and salesrooms to No. 253 Broadway, and are busily engaged in equipping their new factory at the corner of Flatbush avenue and State street, Brooklyn, with modern machinery for making their popular bicycle, coach, miners' and other portable lamps. The removal was necessitated by the large increase in business.

ATTIX WIRE, described in a previous issue, is receiving a well-earned demand. The buyers and users of the wire well remember how Mr. Attix, the inventor, fought for recognition for nearly five years, until last October, when the lighting department of Greater New York approved the wire and allowed its use for all classes of electrical construction work. This wire can be installed without conduits, it being fire and waterproof. It is also impenetrable to nails, and therefore, proof against carpenters, plumbers, etc., who are notorious for raising havoc among the wiring of buildings.

E. H. RYDER & CO., formerly of 180 Broadway, New York City, are now installed in their new quarters, Sixth avenue, near Flatbush avenue, Brooklyn, and are finding a ready sale for their portable and desk lamps. In connection with their regular line of electrical goods, they have taken the agency for the "Eldridge" and "Belvedere" bicycles.

MR. ELMER P. MORRIS, 15 Cortlandt street, reports a big business during the past year, November and December orders having been surprisingly good. He expects to double the output during 1899.

The Electrical Age.

VOL. XXIII—No. 3 NEW YORK, JANUARY 21, 1899 WHOLE No. 610

ELECTRIC LIGHT AND POWER.

Construction of Air Blast Transformer.

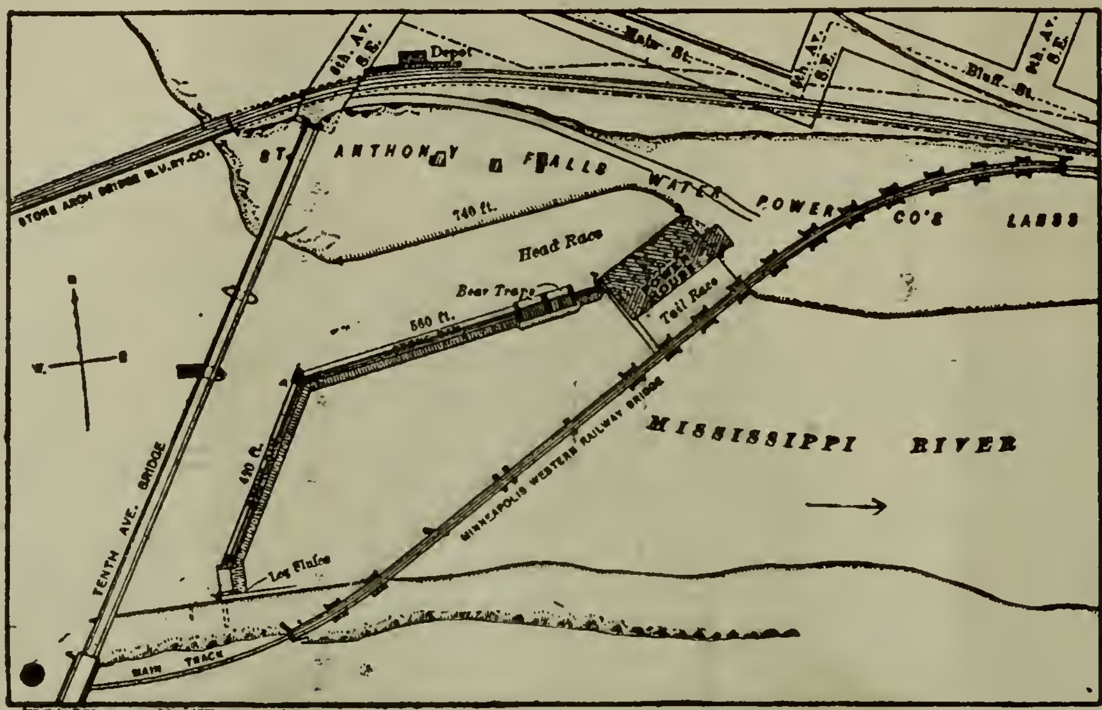
Completed Transformer.

THE ST. ANTHONY FALLS WATER POWER PLANT.

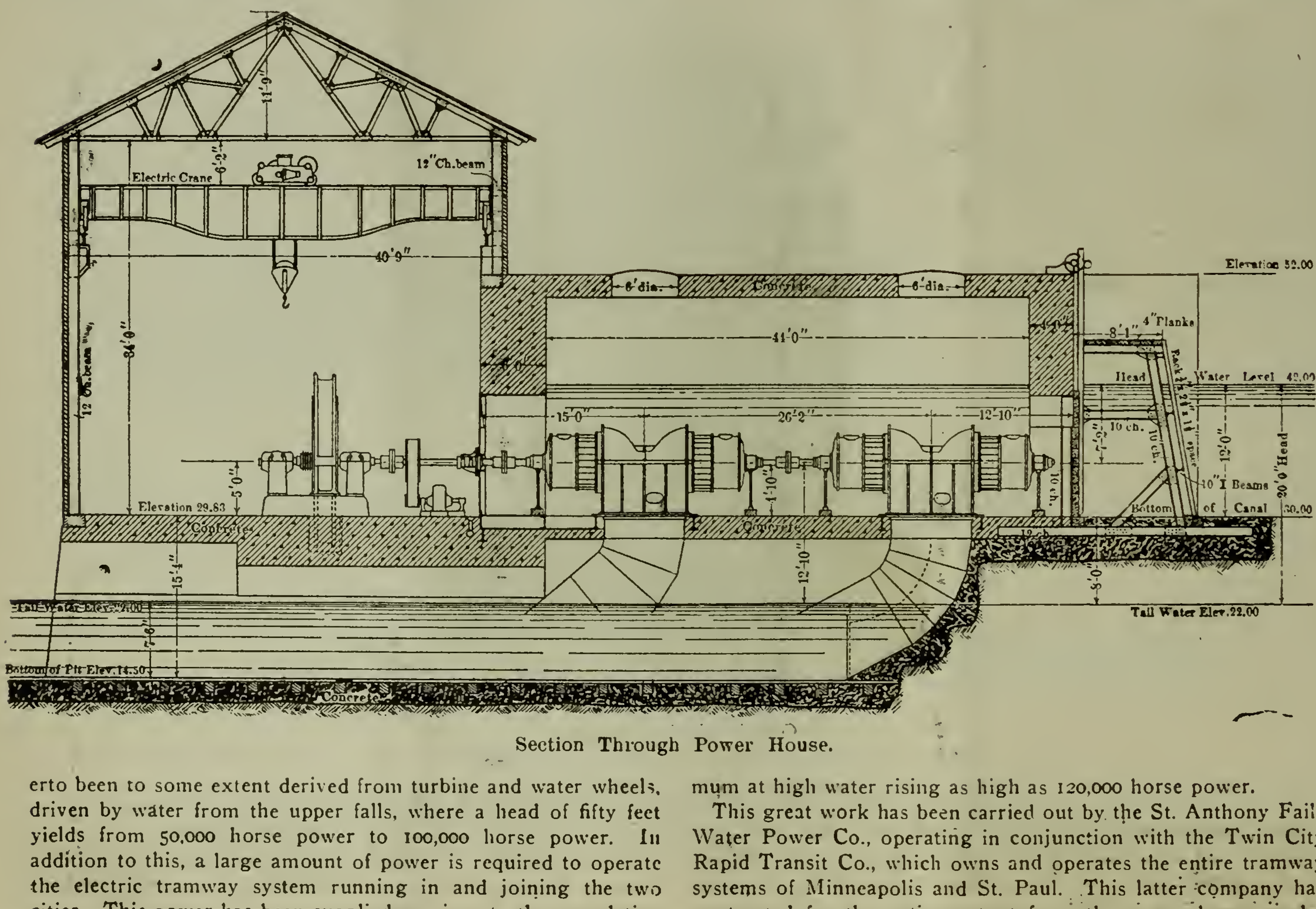
The extensive electrical and hydraulic works on the upper waters of the Mississippi River, where it flows through the city of Minneapolis, are completed, and the twin and rival cities of the great Northwest—Minneapolis and St. Paul—have within themselves developed source of power which, without electricity, had gone to waste, or had only been partially utilized.

In their undeveloped condition the Falls of St. Anthony were nothing more than a series of rapids and minor cataracts spread over a length of the Mississippi of about half a mile. They were divided into two portions, the upper, lying between the banks

and the small island of Hennepin, developed before electricity had broadened the field of water utilization, and the lower, left in its natural state until a few months ago. The Falls lie almost in the center of Minneapolis, dividing it as the Seine divides Paris, in the heart of the manufacturing and milling district, and near to a thickly populated part of the city, which has spread until it has touched the suburbs of St. Paul and thus joined the two cities. Minneapolis is the greatest wheat and maize grinding city in the world, and the north bank of the river is covered with great flour mills and grain elevators. On the southwestern bank are numerous saw mills, which cut into planks the lumber floated down the Mississippi from the forest lands of the Northwest. The power necessary to drive the mills and elevators has hitherto been to some extent derived from turbine and water wheels, driven by water from the upper falls, where a head of fifty feet yields from 50,000 horse power to 100,000 horse power. In addition to this, a large amount of power is required to operate the electric tramway system running in and joining the two cities. This power has been supplied previous to the completion of the work under consideration from three electric stations, in which 5,000 horse power has been generated from dynamos belted and directly coupled to steam engines. Compared to this development, of the power of the upper falls, the electrical and hydraulic work recently completed is of considerable less importance. It makes use of only one of the small cataracts of the lower falls, about 450 yards below the principal fall. At this point a flow varying from 60,000 cubic feet per second to a minimum of about 2,500 cubic feet per second, with an average flow of 6,000 cubic feet, under a head of about twenty feet, is obtainable, but only by the construction of a long dam stretching from side to side of the river. This has allowed of the development of an available average power of 12,000 horse power—the maximum at high water rising as high as 120,000 horse power.



Map of Hydraulic Work.

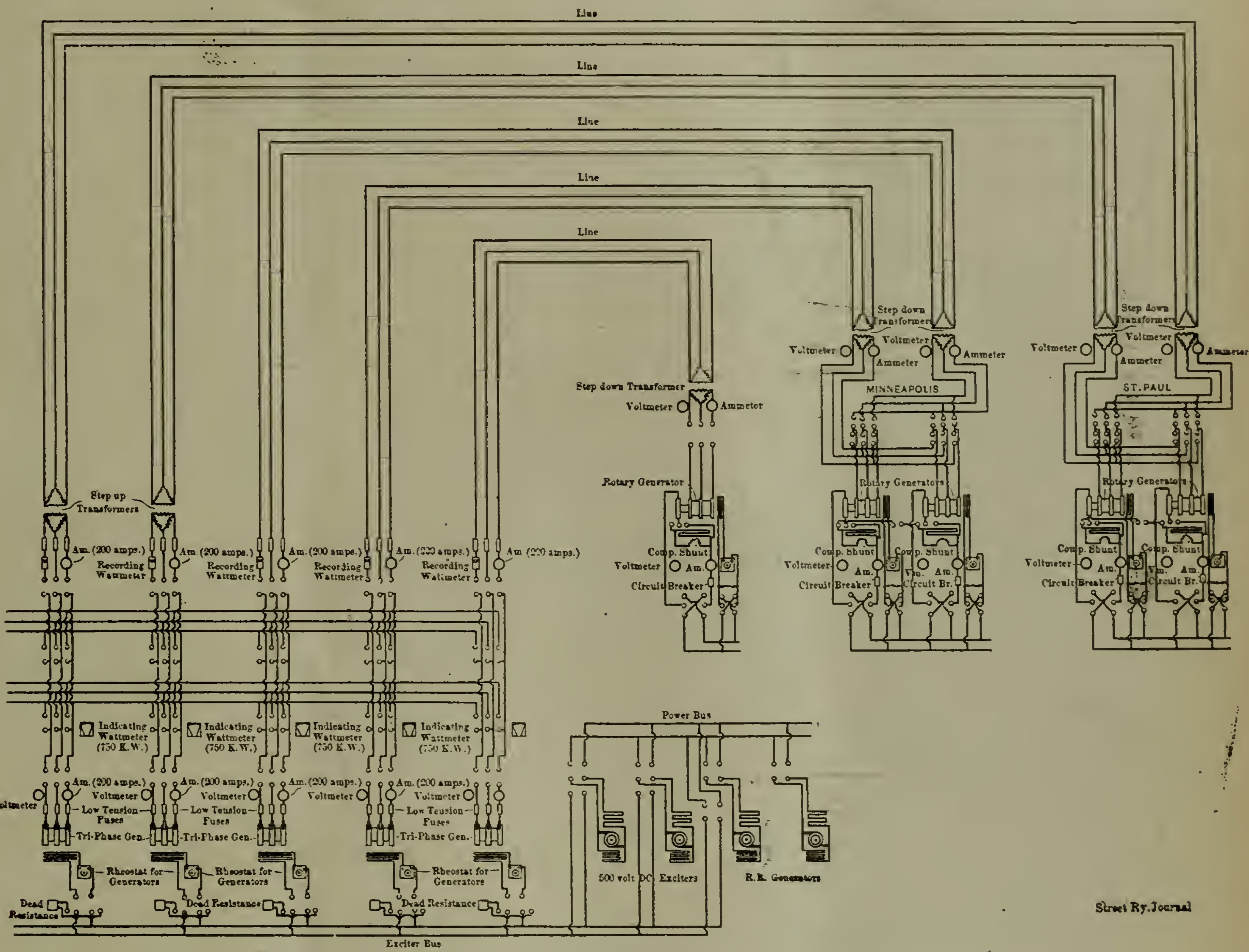


Section Through Power House.

This great work has been carried out by the St. Anthony Falls Water Power Co., operating in conjunction with the Twin City Rapid Transit Co., which owns and operates the entire tramway systems of Minneapolis and St. Paul. This latter company has contracted for the entire output from the power house, under

a lease to run for forty years, the power to be transmitted for distribution to transformer and rotary converter substations—the former steam stations.

The dam is of solid masonry, and has been thrown diagonally completely across the Mississippi. Starting on the south bank of the river just below Tenth avenue bridge, it runs north for 420 feet and then almost due east for another 500 feet. The power house, which is part of the dam, is erected on the left bank of the river, and lies beneath the bridge of the Minneapolis and Western Railway, about 800 feet below the Tenth avenue bridge. The dam is triangular in shape, the apex pointing up stream a little more than midway between the two banks. It is gate folds down, allowing the water to pass over the level deck. By using this type of gate a surface discharge is provided to carry off logs, ice and rubbish which would otherwise be caught in the racks. The third gate is of the slide type, and is worked by large screws, with ball bearing nuts, operated by a small waterwheel in one of the piers. Between the sluice gates and the right bank is a log sluice, and between the sluice gates and the power house is another. Each of these is six feet wide and 200 feet long, with stone walls, and bottom of concrete and railroad iron laid in cement. At periods of high water the logs as they come down pass over the dam; at low water they are passed through the log sluices.



Distribution System.

built of granite, and blue limestone, with stone crib work on the front face and a terraced face down stream. Under ordinary conditions the dam is dry, but at the spring high water the river flows in a heavy stream over the entire width. To relieve the excessive flow and to avoid any backing up of the water into the tailraces of the power plants on the upper fall and thus diminishing their available power, three sluice gates are provided, two on one side of the power house and one on the opposite bank. These gates are known as "bear traps." Each "bear trap" gate is 50 feet long, built of steel and decked with wood. They run between solid stone piers eight feet wide, forty feet long and twenty-five feet high. Two of the gates are apron hinged at the bottom, and supported from behind by hinged supports provided with rollers at the top. To raise the front apron and thus close the gate, water is let into the space between it and the support, which, rising under the pressure, elevates the gate. To lower it the water is let out, when the support drops and the

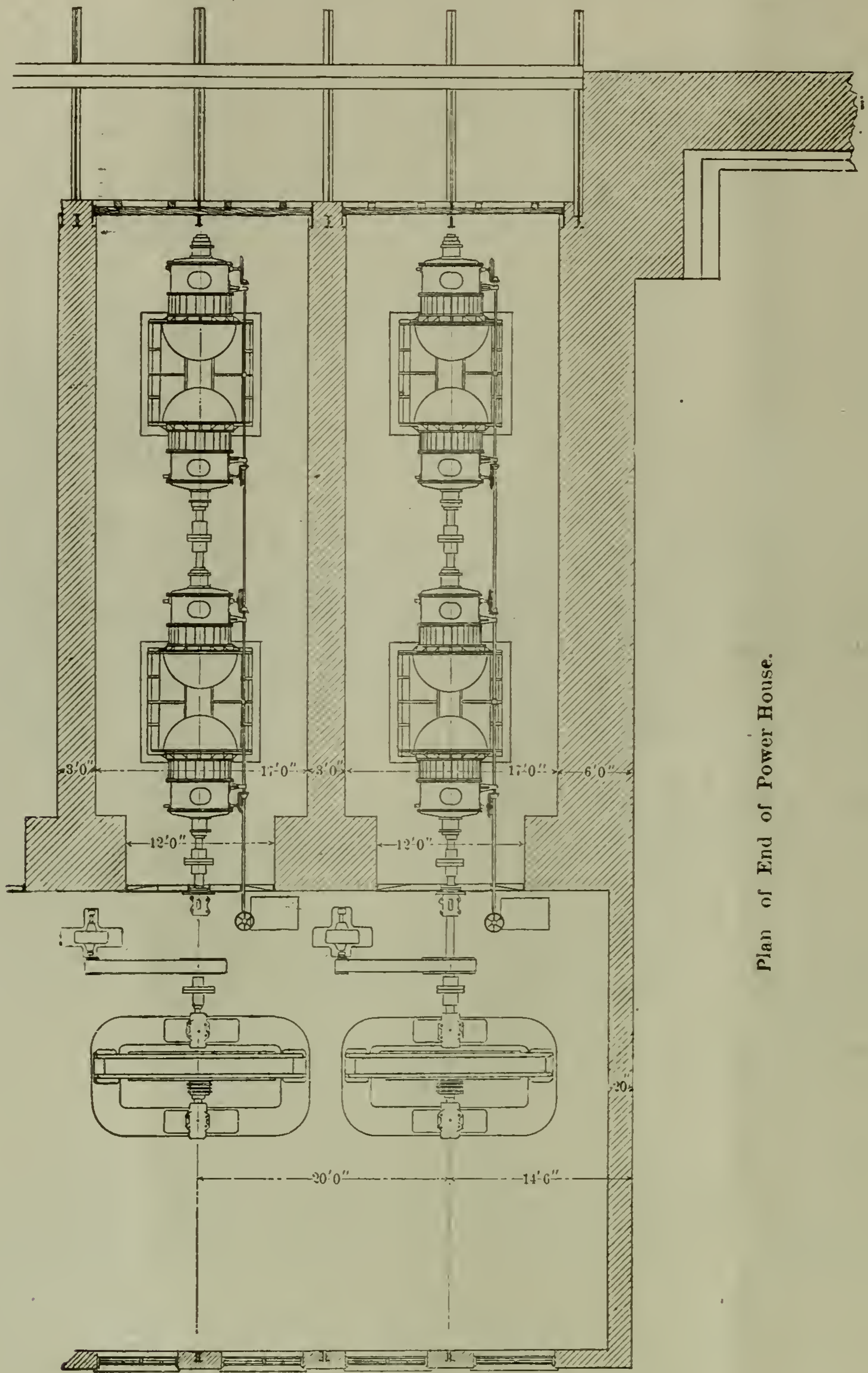
The dam is divided into three sections, the first starting from the log sluice beside the power house, fifty feet long, twelve feet six inches above the bed of the river, extending below the bed sixteen feet. Then come two of the "bear trap" gates. The second section in 444 feet long, 14 feet high above the bed of the river, and similar in construction to that of the first section, except that the coping is of steel and concrete in lieu of granite. The third section is 366 feet long, 13 feet above the bed of the river and exactly similar in construction to the first section. Between this section and the river bank is the third 50 feet wide "bear trap" gate, while between this and the bank is the second log sluice. The down stream face of the entire dam and the sluice gates are provided with an apron fourteen feet wide of concrete covered with steel rails securely anchored, protecting the toe of the dam from wash or scour.

The headrace is 207 feet wide and 600 feet long, the section of the dam facing the left side of the river forming one retaining

wall, the other being the river bank itself. Protecting the wheel chambers is a substantial steel rack frame, extending the whole width of the race, and supporting a steel rack 207 feet long, which prevents the passage of rubbish and ice to the wheels. Over the upper surface of this rack an automatic cleaner, directly driven by an electric motor, travels, gathering up accumulations of floating matter and depositing them upon a traveling belt conveyer, which discharges them into a sluice, through which they pass to the river below the power house.

The power house is a well lighted fireproof building, 250 feet long, 57 feet wide and 51 feet high. The wheel chambers are outside the power house, and are 43 feet wide. In front of the building are the hydraulic forebays, each 40 feet wide and 250 feet long, leading to ten masonry flumes, separated from each other by masonry partitions four feet thick. At the end of each flume a partition or head wall 7 feet 6 inches thick, separates it from the dynamo room, and holds the flume head thimble eight feet in diameter, closed with a cast iron cover. The covers carry the stuffing boxes through which the wheel shafts pass to the couplings on the generators.

Each hydraulic unit consists of four horizontal Victor turbines, each forty-two inches in diameter, run at a speed of 130 revolutions, each gives 250 horse power. They are erected in the turbine chambers, four wheels on a single shaft, giving a total to each unit of 1,000 horse power. The water passes into each flume through two head gates, each eight feet wide and nine feet high, operated by a hoisting attachment on the deck of the wheel chamber. Each set of four turbines discharges into a separate arched tail race tunnel, passing under the power house and discharging into the main tail race, 100 feet long, below the power house. The floor of this race, as well as the foundations of the power house, is of solid concrete, two feet thick. At the eastern end of the power house are two two-inch horizontal wheels, used to drive the exciting dynamos.



Plan of End of Power House.

The governor used to control the admission of the water to each wheel is the B type of Lombard governor, guaranteed to hold the speed of the wheels constant and momentary fluctuations due to large load, to within 5 per cent. of normal under all con-

The Electrical Age.

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NEW YORK, JANUARY 21, 1899.

CONTENTS:

ELECTRICITY FOR PHYSICAL IMPROVEMENT.

Prof. Thatcher, of Yale University, performed a series of experiments with electricity for the purpose of discovering whether its influence upon the tissues was beneficial or not. His experiments took a practical form and were satisfactory, as far as results were concerned.

A man suffering from paralysis was allowed to test his strength so that the extreme effort could be measured. A current of electricity was then applied to one arm and then the other. A decided increase in strength was shown by the end of the third week. It seems as though the nervous system in this case received sufficient stimulation from the current to show a decided improvement.

What physicians call "a galvanic current" was used; that is to say, a current not produced inductively. The catalytic action with a powerful current is such that under the positive pole, as well as the negative, apparently foreign matter collects and sores are apt to be produced of an extremely painful and lasting nature. It is not a current of this kind which when thus misapplied can ever aid the system in any respect whatsoever. But, for such malignant growths as tumors, or, possibly, cancers, a powerful galvanic current may mean the thorough destruction of them with a possible future cure.

Surgery does not gain very much by the use of electricity in a certain and positive sense, except where cautery work is to be done. Yet a great deal of dependence is placed on electricity on many occasions where the use of the knife is prohibited, and a patient feels safer and is more content with a more radical cure. Catalytic action; that is to say, depending upon a strong current, for the removal of unsightly hairs, has been a pronounced success, and certain dermatologists, as they style themselves, place every faith in the moderate and skillful application of electricity.

The reduction of cancerous growths and tumors is, of course, a matter of vital importance to the surgical world, as many fatalities result from operations, which have been delayed through the risks that inevitably attend their extirpation. Whatever electrolytic changes may be brought about by the passage of a current through a fungus growth of tissue, there seems to be at least a popular verdict in favor of continued experiments along those lines.

Cataphoric action, that is to say, the employment of a current for the purpose of driving an anaesthetic into the tissues is to many dentists an important feature of their work. An electric current will carry cocaine through the skin and deaden all sensation in the underlying tissues with all the ease and thoroughness obtained by using a hypodermic syringe. It is merely necessary to consider Ohm's law in such a case. Allow enough pressure to send through the tissues milli-amperes sufficient to transfer the drug. In certain neuralgic troubles relief is almost instantaneous by following this system and a more general application of it would probably quiet the nerves of many patients and ease the minds of those that attend upon them.

It is generally believed that the tissues are only affected by three causes, which may be physical, chemical or mechanical. It might be well to add a fourth, the phsycological, because through certain species of worriment organic changes are brought about and the manifestations of disease become very perceptible. To some of this class affected, as described, the quieting effects of an electric current has frequently been remarked.

Many physicians will speak of the rapid cures effected by the use of static machines upon patients suffering from nervous headaches, etc. The facility with which the current enters the nervous system and in many cases effects cures has been admitted to be rather astonishing. To quote from an article written by Dr. M. Allen Starr, is interesting and instructive.

"To the quieting effect produced by the positive pole of a current is due the relief of pain which follows its application. For it is generally admitted that in many painful afflictions of a nervous or muscular character the application of a mild, continuous voltaic current with the pole upon the painful part, affords prompt relief."

ELECTRIC LIGHTING FROM A COAL STANDPOINT.

The marvels of ingenuity displayed by steam and electrical engineers when exposed to the light of criticism are like the well-finished wheels of a watch that can never keep good time. The result is bad. In spite of our knowledge of fundamental principles there seems to be a striking difference between theory and practice.

This difference becomes alarmingly great when it is realized that out of every hundred pounds of coal consumed only the equivalent of one pound is effective in producing light. At this rate the enormous waste of fuel going on for the purpose of obtaining this meager result is frightful to contemplate. It means that one hundred pounds of coal represent one hundred and fifty that have been mined, fifty of which is wasted in the operation, and ninety-nine more go up in smoke and disappear as radiated heat in the elaborate system employed for the production of light.

The control of the heat and its efficient use is certainly one of the greatest problems of the century.

ditions. This is belted to a small pulley on the turbine and generator shaft. It consists of a governor directly controlled by the belt and three consecutive hydraulic rams, the third operating the gate closing mechanism.

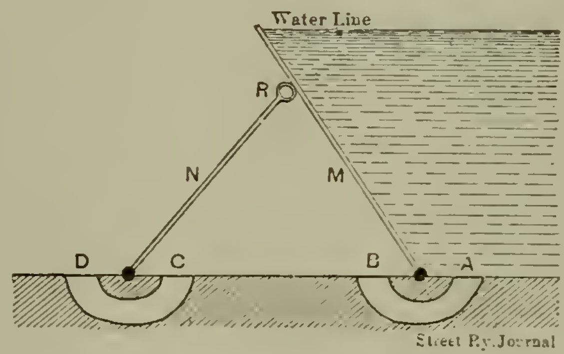
The dynamo room runs the entire length of the building, and is lighted with windows looking west down stream. A gallery ten feet wide runs along the east wall. In this gallery are the switchboard transformers, lightning arresters, etc., and the general offices, while below is a recess in which the cables from the switch board run. An electric traveling crane runs from end to end of the room. In the illustration showing the plan and section of the plant, an exciter is shown belted to each generator. This was changed lately, independently driven exciters being employed.

To avoid shut-down from possible scarcity of water, or extreme frost, provision has been made in the design of the dynamo room for a steam plant of capacity equal to that of the hydraulic plant. In line with each generator a 1,000 horse power vertical triple expansion engine will be erected, to be coupled to the extended shaft of the dynamos. A 12,000 horse power boiler plant will be erected on the bank side of the power house. The installation of this steam plant, while decided upon, has, however, not yet been begun. The ultimate capacity of the plant is 10,000 horse power in ten hydraulic or steam and electrical units of 1,000 horse power each.

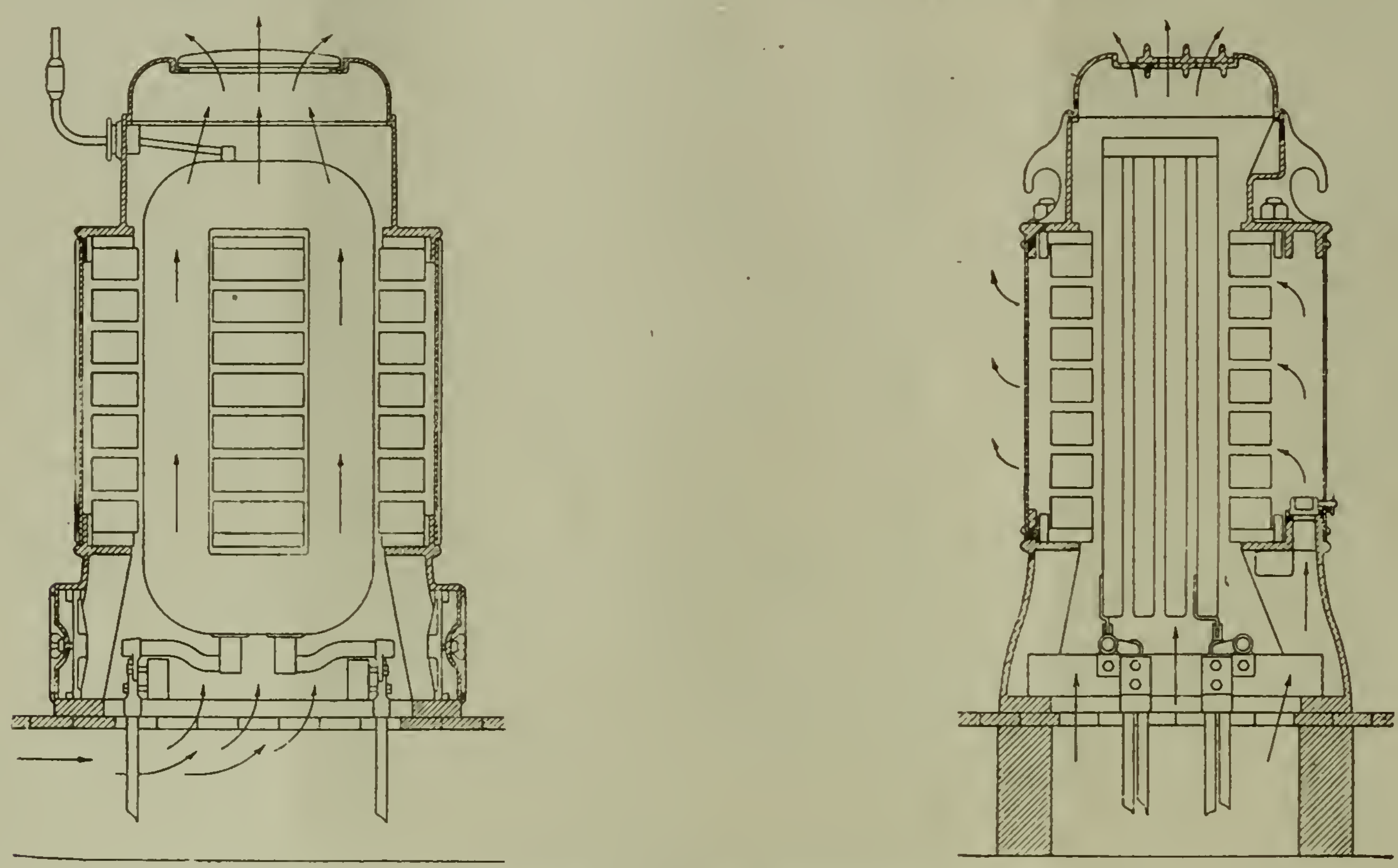
The system of distribution is a combination of the direct current and three-phase alternating current, the former generated for the service of the Minneapolis tramways, and the three-phase with converter sub-stations, for the suburban and interurban and the St. Paul roads. Five alternators and two direct current dynamos are now in position in the power house, two alternators and one direct current machine will be erected as soon as the demand warrants.

The alternators are of the thirty-six-pole revolving armature type, with a rated output of 700 kilowatts or about 1,000 horse power, at 3,450 volts when running at 133 revolutions per minute. The periodicity is thirty-five cycles. Each alternator stands 10 feet 8 inches high, on a base 12 feet 6 inches by 10 feet 10 inches. The armature shaft is extended 12 inches beyond the outer bearing, to allow the engine coupling to be attached when the steam plant is installed. The poles are built up of steel laminae insulated from each other by a coating of japan, and are cast into the field ring, which is heavily ribbed, to increase its rigidity. The field winding is made upon metal shells, from which it is thoroughly insulated, and poles and winding are arranged for easy removal of the latter from their position without disturbing either armature or the balance of the field structure. The field frame may also be moved along the base parallel with the shaft, to allow the armature to be inspected and repaired without unbolting and lifting the upper half of the field ring.

The armature is of the slotted core type, built up of laminations, which ,to avoid the use of bolts, are dovetailed into the spider as the central support is called. Ventilation of the core is secured by air spaces radiating at intervals from the center. The laminae are insulated, and previous to the application of the coils, the slots are also lined with a substantial insulation. The coils themselves are all made and insulated before application to the core. The diameter of the armature is 7 feet 6 inches, and the peripheral speed 3,140 feet per minute. The air drawn in through the spider circulates through the ducts in the core and thoroughly ventilates the armature. The collector rings are in a separate spider, insulated from it by heavy molded mica, and



"Bear Trap" Gate.



Ventilation System of Transformers.

from each other by thick insulation discs. The armature complete weighs 25,000 pounds, the complete alternator 84,000 pounds.

The direct generators are eight-pole machines, each of 700 kilowatts capacity. The no-load voltage is 575 volts, and the dynamos are over compounded to 600 volts. In these the ribbed field and poles are of cast steel, the poles being bolted to the field ring. The spools are of malleable iron, with the shunt and series winding placed side by side, instead of over each other. The armature is built up of laminations dovetailed to the supporting spider, with four-inch ventilating ducts. The winding is of insulated copper bars set in the peripheral slots, and the commutator and shell being forced over an extension of the armature spider, are made a solid part of the armature. Hand wheels with worm and screw control the movement of the brushholder and shift, raise or depress the brushes simultaneously. The weight of the armature is 34,000 pounds, of the complete generator 110,000 pounds.

The exciters are six-pole, 100 kilowatt, 280 revolution direct current machines, supplying exciting current at the same pressure as the larger direct current dynamos, the construction of which they closely follow. The armatures of these each weigh 3,200 pounds. They are directly connected to the smaller turbines.

The system of distribution is clearly shown, as are the details of the main and subsidiary switchboards. The main switchboard occupies the gallery over the generators. It is of the panel type, and is divided into three sections, alternator, railway and exciter—23 panels in all. The panels are of polished blue Vermont marble. The alternating current switchboard consists of one panel for each generator and five feeder panels. Any alternator may be connected to any feeder, or all may be run in parallel, and two sets of independent bus bars are provided for convenience in starting the rotary converters. The direct current switchboard is made up of two generator panels, eight double feeder panels and a total output or station panel, the latter carrying a 700-volt voltmeter and 2,500 ampere station output recording watt meter. The meter board has two panels, one for each exciter. Each of the panels carries its full equipment of standard instruments and switches. The direct current panels are in addition provided with automatic circuit breakers. At one end of the gallery are set the increasing or step-up transformers for the transmission, and the static discharge board equipped with alternating current lightning arresters of the short gap type. This is made up of three panels, two for two 3,500-volt circuits; and one for the 12,000-volt circuit, differing from each other only in the number of gaps provided. The step-up transformers are six in number, each of 233 kilowatts, and are of the air-blast type. The core of these is built up of well tested iron lamination, supported on and insulated from an iron frame and divided into sections. Air ducts running up through these and between the coils allow of perfect ventilation by cool air blown through them from underneath. The force of the draft is controlled by shutters at the top. The air is furnished by a sixty-inch blower, driven by a four-pole direct current 500-volt motor, directly connected to the fan shaft. It supplies three cubic feet of air per minute at one ounce pressure per kilowatt to the transformer, while the energy required to drive the motor is little more than one-tenth of 1 per cent. of the full load kilowatt capacity of the transformer. The efficiency of these transformers is 98 per cent., and they are designed for extremely close regulation, varying only 1 per cent. from no load to full load. Each transformer was subjected to a test of 20,000 volts alternating before acceptance. Each weighs 4,500 pounds, and stands 58 inches high, on a base 38 inches by 33 inches.

The direct current is fed directly from the switchboard into the main railway overhead system of Minneapolis, over lead covered cables, some running to the trolley line direct, others to a tower about 200 feet away, from which the cables run underground to feeding points on the Minneapolis and St. Paul interurban system.

The system of distribution of the alternating current is more complex and necessitates three separate transformation and conversion sub-stations—two in Minneapolis and one in St. Paul. These plants are installed in the buildings containing the steam plants, now still and unused, of the Twin City Rapid Transit Co., and the two plants, side by side, admit of a striking comparison. Sub-station No. 1 is near the center of Minneapolis and contains six step-down transformers of 215 kilowatts each, two induction regulators, two alternating and two direct current switchboards and two 600 kilowatt rotary converters. Sub-station No. 2 is four miles from the power house, and contains 215 kilowatt transformers and one 600 kilowatt rotary converter. Sub-station No. 3 is in St. Paul, and ten miles distant from the power house. Its electrical equipment is similar to that of No. 1. To sub-station 1 and 2 the current is transmitted at the initial voltage of 3,450 volts over two triple conductor lead covered cables, laid in cement lined iron conduits, with manholes 500 feet apart. The course of the current from the switchboard is first, through a bank of alternating current lightning arresters, then over the transmission lines to the step-down transformers, in which the pressure is reduced to 387 volts. At this pressure it enters the converter switchboard, and passing to the alternating current side of the converters is changed in nature, issuing from the commutator side continuous current at 600 volts. It then passes through the railway panel of the switchboard to the overhead wires.

The transmission to sub-station No. 3 at St. Paul involves the use of the step-up transformers at the power house. In these the pressure of the current is raised to 12,000 volts and takes a course similar to that just described, and a similar reduction and conversion is also effected, the current entering the main St. Paul direct current network at normal working pressure.

The construction of the step-down transformers is similar to that of the raising transformers, and they are also cooled by an air blast from fifty-inch blowers, directly driven by four-pole 550-volt motors. The rotary converters are eight-pole machines of 600 kilowatt capacity, each running at 550 revolutions with a direct current voltage of 580 volts at all loads. The alternating current, or receiving voltage is that of the secondaries of the step-down transformers—387 volts. The general design and construction of these rotaries are similar to those of the railway machines, with the addition, of course, of the alternating collector rings. The interior diameter of the armature is six feet and the peripheral speed 7,500 feet per minute. The approximate weight of each converter armature is 17,500 pounds, of the completed machine 51,000 pounds.

Owing to the comparatively short distance between the generators and the converters, and the use of underground cable instead of an overhead line, artificial inductance has been introduced to secure the necessary flexibility in the direct current voltage of the rotary. This consists of a three-phase open magnetic circuit inductance coil placed between the transformer and each rotary, and allows of a great range of adjustment in the direct current voltage. The coils are simple bundles of iron wire wound with a finely stranded cable, and are assembled in protecting cases. They are cooled by a current of air taken from the blower, which cools the transformers. These coils are also useful in preventing idle current from circulating between the two rotaries operated from the same transformer, should their field adjustment not be carefully made.

The switchboard in sub-stations 1 and 2 consists of two alternating and two direct current panels on each. In sub-station No. 2 one alternating and one direct current panel. They are similar in general construction to the panels of the switchboard in the generating station. In order to protect the rotaries in case of reversal of current, an automatic device is provided in each direct current panel, which, in case the current on the direct current side should be reversed, the circuit breaker is automatically brought into action, breaking the circuit and protecting the machine.

One unique feature of this installation should be mentioned. Whereas, the majority of water power plants have come into being to supply power where steam was absent, this plant has supplanted a complete steam system, and no more impressive comparison can be conceived than that afforded by a view of one of the plants made up of rotary converters and transformers operating in silence, standing beside great engines with belts and countershafting, backed by huge batteries of boilers, all su-

perseded and still. The amiacable co-operation of hydraulic engineers, alternating current electrical engineers and the engineers of tramways system has resulted in the construction of an electric generation and transmission plant, a model of the most advanced electrical practice.

Our thanks are due to Mr. William De la Barre, chief engineer; E. P. Burch, electrical engineer of the Twin Cities' Rapid Transit System, and to Mr. I. R. Edmands, engineer in charge, representing the General Electric Co. of America, the contractors for the entire electrical system, for much of the information contained in this article.

MISCELLANEOUS SCIENCE.

STRAY CURRENTS.

ELECTRIC MOTOR CAR STATIONS.

Under the title of "La Poste Electrique Internationale," a company has been formed in Belgium, with a capital of £320,000, for the novel purpose of establishing on all the principal high roads of Europe electric motive power stations, or electric posting stations for motor cars. A financial daily says that each of these stations will be in charge of expert mechanics, repairs will be quickly executed, and accumulators can be recharged.—Ex.

ELECTRIC PURIFIERS.

In a town where the electric light is used, the electrical installation already existing would be quite enough for the purification of the water supply of the town. Thus all the use of land for filter beds can be saved, and that now appropriated for them could be utilized in other ways. This is a most serious consideration, especially when the filter beds have to be roofed at an enormous expense. Many experiments with this water purification scheme have been made, and are still in progress, on the Continent, especially in France and Belgium.—Ex.

THE GREATEST INVENTION.

In a competition recently held by "Tid Bits" to ascertain which were generally considered the most important inventions of the century, the voting resulted as follows: 1, Telegraph; 2, steam engine; 3, X-rays; 4, telephone; 5, electric light; 6, photography; 7, phonograph; 8, anaesthetics; 9, sewing machine; 10, gas.

CORUNDUM.

Corundum is composed of the oxide of aluminum (A1203), but traces of the oxides of other metals are generally present as coloring materials. As in the cases of other minerals of non-metallic luster, the color of corundum varies considerably. Sometimes the mineral is colorless or white, and at other times it is found possessing a blue, pink, red, brown, gray or other color. The relative weight of corundum compared with equal volumes of many other minerals is high. It has a specific gravity of about 4, while feldspar has a specific gravity of from 2.4 to 2.7, and quartz of 2.5 to 2.8.—Ex.

MAN POWER.

According to "Indian Engineering," it has been proposed to run dynamos for electric light purposes on the Indian frontier by treadmills operated by convicts. The work would, we presume, be conducted on the piece system—i. e., so many units per day—and in this case the heavy convict will have a great advantage over his leaner co-prisoner. We are afraid that the system would, however, tend to reduce the weight of the convicts to a minimum, as the less a man weighs the farther he would have to move.

MICA MINING.

The rapid development of electrical industries has been attended by a correspondingly rapid growth of mica mining. The American demand for mica is partly supplied by Canada, New Hampshire and North Carolina, but more than half the world's consumption is what is known commercially as Behar mica, from the districts of Hazaribagh, Gaya, and Monghyr, in India. At these Indian localities some 300 mines are now being worked. Last year's output reached nearly 2,000,000 pounds, of which about half was exported from Calcutta, chiefly to England and the United States.—Ex.

THE FEATS OF MODERN SCIENCE.

THE ENGINEER.

Mr. C. W. Hunt devoted his address on retiring from the presidency of the American Society of Mechanical Engineers to "The Engineer." The following is an extract from "Power:"

Whichever way engineering may develop as time rolls on, its elevating influences are constantly at work on the mind and on the character. The work is carried on under unchangeable laws, which must be rigorously applied and adhered to, or failure is sure to result. Man builds to master, to resist, or to guide the forces of nature. If he has rightly judged the conditions, his work stands as a permanent monument of the fact; but if otherwise, the irresistible laws of nature will develop the defect and discover his ignorance, incompetence, or error to every observer.

Hence he laboriously seeks out the unseen laws and forces, then expresses the revelation in a workable form for his daily use. He tests his materials with painstaking refinement. He measures electric resistances with an accuracy now reaching the point of one in four millions, time to the one three-millionth part of a unit, divides a circle with a mean error not exceeding the one-millionth of the circumference, makes surfaces six inches square with a variation from absolute flatness of less than one-two-hundredth thousandth of an inch, rules lines which vary from absolutely perfect spacing by only one-three-millionth part of an inch, sees clearly the spectrum of samarium when one part is diluted with three million parts of lime, and surveys lines eleven miles long in the open air with an average variation in three measurements of only four-tenths of an inch.

Working in a field and in touch with a body of his fellow men having similar tastes, he sees on every hand scenes of engrossing interest. The telescope recording the position and motion of stars which no human eye has ever seen; the spectroscope analyzing the materials of the sun and stars with all the accuracy which it would show if the articles were in the laboratory; looking with Roentgen rays through a double-barreled rifle and seeing not only the leaden bullets within the steel barrels, but also the wads and the charges; and photographing lines in the ultra-violet spectrum far beyond the reach of our vision. He stands by a quartz filament galvanometer which indicates an electric current so minute that if it should be increased in magnitude eight hundred thousand times it would still be only the one-millionth part of an ampere, and on the other hand sees the Niagara electric generator of five thousand horse power, with a current so much larger than that of the galvanometer that the difference can only be expressed mathematically, not in colloquial language. He sees with entrancing interest the liquefaction of hydrogen by the physicist at a temperature of only twenty-three degrees centigrade above actual zero. He shares in the enthusiasm at the results of two years of unremitting work in the photo spectrum in isolating a new element—monium, in the Hertz electro-magnetic waves now applied in wireless telegraphy, and in the newly discovered element in the salts of uranium, whose radiations make the air through which they pass a conductor of electricity. More nearly touching him personally comes the work of the biologist, whose quest for the thing we call life has continued from the primitive man to the present time. Constantly flitting from his grasp, it has seemingly passed from fire and storm to mountain and deep, from animal and plant to seed, to cell, and now it has been followed to the molecule or the atom, and yet it as completely eludes his grasp or even his

comprehension as ever it has. But followed it certainly has been, by all the laws and forces of nature at the command of man, until the search for it is now in the molecule or the atom, a space physically so small that only the trained imagination can even faintly comprehend its minuteness.

And there, on the outskirts of this unexplored world, stands man, with spectroscope and polarized light, peering over the sphere of action which we call an atom, well knowing that therein lie the wonderful forces, activities, and at least the effects of that mysterious entity, life itself. He sees a field for investigation so fraught with possibilities, so infinitely beyond the comprehension of any conception of the capacities of the human mind that he stands gazing into the abyss with the same devout wonder and awe as does the astronomer when viewing the illimitable heavens. The two are standing, as it were, back to back, and each gazing into an infinity—one into the infinitely great, and the other into the infinitely small.

Thus stands the engineer in the midst of a countless number of earnest explorers in the field of unrevealed nature, and so to speak, sees the tools formed and the materials discovered with which he is to work. Cheerfully can he enter upon his daily tasks with the consciousness that his application of these discoveries is of real service in lightening the burdens of life, as well as elevating and ennobling his fellow men.

TELEGRAPHING WITHOUT WIRES.

ETHEREAL TELEGRAPHY.

Marconi's miracle of wireless telegraphy is the theme of much congratulatory writing in the reviews. The speculations to which these achievements have given rise are illustrated by the "Edinburg" in this citation from Mr. Preece:

"'Strange mysterious sounds,' he tells us, 'are heard all along telephone lines when the earth is used as a return, especially in the calm stillness of night. Earth current are found in telegraph circuits, and the Aurora Borealis lights up our northern sky when the sun's photosphere is disturbed by spots. The sun's surface must at such times be violently disturbed by electrical storms, and if oscillations are set up and radiated through space, in sympathy with those required to effect telephones, it is not a wild dream to say that we may hear on this earth a thunder storm in the sun. If any of the planets be populated with beings like ourselves, having a gift of language and knowledge to adapt the great forces of nature to their wants, then if they could oscillate immense stores of electrical energy to and fro in telegraphic order, it would be possible for us to hold commune by telephone with the people of Mars.'"

Yet the reviewer does not consider any revolution to be imminent:

"The addition to the resources of civilized mankind made by wireless telegraphy is of a subordinate, if of an extremely significant, kind. In the exigencies of war, above all, it might prove of vital consequence. The hostile raids of wire cutters would, by its means be renedered comparatively innocuous. * * * The mischiefs of cable lifting would similarly be in part neutralized. Submarine connections will almost certainly very soon become superfluous between adjacent islands—between, for instance, Great Britain and Ireland, the Orkneys, Shetlands, Hebrides and the Channel group. In military and naval operations this mode of signaling ought to prove invaluable. The galloping aid-de-camp may perchance be eliminated from the battle field; the flutter of tell tale bunting need no longer be anxiously watched for at the mast head; and the flag code may rest undisturbed in the captain's cabin.

"Hertzian waves are as indifferent to weather as stormy petrels; they travel with the same ease in tempest, fog, or sunshine. This robustness of constitution adapts them peculiarly for one of their primary tasks—the office, that is, of keeping up communication with lightships and island lighthouses * * * the sunken defenses of a fort can be entirely isolated, and need no longer offer to an enemy vulnerable lines of connection with batteries on terra firma."

The "Edinburg" concludes its article by recognizing in an ethereal telegraphy the finishing touch to the discovery of the luminiferous ether, and quotes Dr. Lodge's sketch of nature's penetralia:

"'One continuous substance filling all space, which can vibrate as light, which can be sheared into positive and negative electricity, which in whirls constitutes matter, and which transmits by continuity, and not by impact, every action and reaction of which matter is capable. This is the modern view of the ether and its functions.'"—From the "Review of Reviews."

ELECTRICITY IN THE FOUNDRY.

The electrical power arrangements which are now in operation at the works of the Reading Car Wheel Co., Pennsylvania, are said to constitute the most complete electrical equipment ever installed in a foundry. The adoption of electricity for motive power in this instance was founded on a belief that it would prove to be more economical and convenient than steam; and, although no comparative figures are available, there would appear to be a decided conviction on the part of the company that the expectations formed have been fully realized. The "Iron Age" informs us that the current is taken from the mains of the city lighting plant, and the system covers all appliances that can be run by power. The blower of the cupola is driven by a 35 horse-power motor; the tumbling barrel is also directly connected to a back-geared motor, and is used to separate the scrap iron and dirt coming from the cupola. In the cupola charging room are located the motors for driving the elevator, and the drop for breaking old car wheels. The motors have reversing elevator controllers, and are directly connected to a Bloomsbury elevator. The latter has a capacity of three tons, and the drop, which weighs 18 cwts., has a fall of 40 feet. The large ladle, holding about five tons of metal, is mounted on trunnions, and is turned by a motor. The small ladles are carried to the front of the larger one, and each is filled in turn and carried to the different floors. At the rear of the building are placed the motors for operating the system over the floors—two motors on each floor, one for moving the carriage, the other for the hoist. They are required to be dust and heat proof, the temperature in their vicinity is often 150 degrees, but they do not appear to suffer in consequence. From each controller is run a hand rope to the floor, so that each molder has perfect control of the speed, and can vary it from one to fifty feet per second on the hoist. The working of this plant will be watched with interest by iron founders; but we may infer that it can only be successfully carried on buildings especially arranged, and in works that are confined to one speciality of manufacture.—Ex.

ELECTRIC RAILWAYS.

PROPOSED RAILWAY IN NORTHERN MEXICO.

Consul Griffith writes from Matamoros, Dec. 16, 1898:

The fact that a company under the name of the Chicago, St. Louis & Texas Air Line Railway Co. has been chartered to build a road from San Antonio to Brownsville, Tex., and the entire route surveyed, has caused interested comment among men prominent in business and financial circles in Matamoras and northeastern Mexico. The commencement of this road will undoubtedly result in the building of a road from Matamoras

to Mexico City. It seems strange that a road has not already been constructed, not only because it would traverse a country of the most varied resources—agricultural, grazing and mining—but it would be by from 400 to 600 miles the shortest route from Mexico City to the large manufacturing cities in the central and eastern part of the United States.

ELECTRIC TRACTION IN ENGLAND.

Mr. James Ross, the vice-president of the Montreal Street Railway Co., who has recently returned to Canada from an extended visit to Great Britain, has made some interesting remarks upon street railways in Britain and other matters, in the course of an interview with the "Montreal Gazette." Mr. Ross observed that while he did not wish to cast any reflections upon the municipal bodies of Great Britain as regards the slow manner in which they moved, yet it was a fact that most of the cities were extremely conservative in the matter of a change from horse or steam to electrical power. The overhead system appeared to be generally accepted, and Liverpool and Glasgow, which had purchased their respective street railway systems, had each from two to three miles in operation. Bristol and Dublin were also to have the trolley. In Birmingham the people were undecided what course to pursue, and they will, Mr. Ross added, probably await results in the other cities. Mr. Ross is decidedly out in his details, or else he has been badly misreported.

PRODUCTS OF THE ELECTRIC FURNACE

ACETYLENE FOR GAS ENGINES.

In a recent pamphlet, issued by Mr. F. Grover, Leeds, England, are to be found some very interesting results of experiments carried on with acetylene as a motive power for gas engines, says the "American Manufacturer."

Mr. Grover began by firing mixtures of air and acetylene at atmospheric pressure, and found that 1 part of gas and 18 parts of air was the weakest mixture that could be ignited. The pressure developed was about three times as great as when a similar mixture of coal gas and air was ignited, and the rate of combustion was much more rapid. When 7 parts of air and 1 part of acetylene was ignited at atmospheric pressure, the pressure developed was 111 pounds per square inch, the highest point reached.

On raising the initial pressure to 2 atmospheres, and igniting a mixture of 11 parts of air and 1 part of acetylene, the pressure developed was 197 pounds per square inch. On using the same mixture and starting with a pressure of 3 atmospheres, the pressure developed was 350 pounds per square inch. Of especial interest is the statement that with an initial pressure of 3 atmospheres, it was possible to ignite a mixture of 30 parts of air and 1 part of acetylene, the pressure developed being 180 pounds per square inch.

The author thinks that from a thermodynamic standpoint, acetylene would be a very useful addition to the list of gas engine fuels, but that the present price is prohibitive, for it would cost 2s. 6d. per horse power hour.

ELECTRIC METERS.

"THOMSON RECORDING WATT METERS."

Ten years ago electrical energy was invariably supplied at a fixed rate per month for each installation, without much regard to the amount actually furnished. To-day electric stations in this country supply on a meter basis the electricity they manufacture with resultant advantage to the station economy. Some idea of the extent to which the meter business in this country has grown may be gathered from the fact that not less than 200,000 Thomson recording Watt meters alone have been manufactured and sold by the General Electric Co.

The business has grown from small beginnings by the persistent missionary work which has been carried on by this company through agents and literature. The latest addition to meter literature, issued from the General Electric press, is "Thomson Recording Watt Meters," a handsomely printed and illustrated brochure in a rich cover, dealing with the different types of these recording energy meters, which the General Electric Co. manufacture, their uses and their advantages. Each type of meter is clearly described and so illustrated that its construction can be readily understood. Full instructions are given for the care, connection and reading of these moters.

The pamphlet should be found in the library of every electric light and power station, and will be sent on application made to the Schenectady office of the General Electric Co.

ROENTGEN RAYS.

A NEW FLUORESCENT CRYSTAL.

A new mass, phosphorescent under the X-rays, occurs in the substance lately introduced by Van Molekebeke, which is said to be more sensitive for phosphorescent screens than all the substances heretofore known and employed. The production of the mass is as follows: Dissolve 1 gramme of uranium nitrate in 4 grammes of boiling water in a porcelain dish, adding 1½ grammes of ammonium fluoride, and boiling the mixture a few minutes. The solution, which should not contain any precipitate, is cooled off and crystallized, which takes place in an hour. The octahedral crystals deposit on the bottom of the vessel, and the pale yellow solution turns perfectly colorless. The liquid is poured off from the sediment, and the latter, for the purpose of a complete removal of the ammonium nitrate, is repeatedy washed with cold water. The crystals are insoluble in cold water, but readily soluble in hot water. For the production of luminous screens, the dried preparation is mixed with collodion or gelatine. The quality of the preparation depends upon the perfect development of the crystals. The combination of the body is expressed by the formula $U_2O_2Fl2\ 4NH_4Fl$—uranium ammonium fluoride.—Ex.

AMONG THE SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

"Standing room only" was the lot of latecomers at the one hundred and third meeting of the New York Electrical Society, at the College of the City of New York, on Jan. 12.

The subject of the evening, which was, "Latest Progress in Storage Battery Installations," was ably handled by Mr. Joseph Appleton, engineer of the construction department of the Electric Storage Battery Co.

The meeting was a significant illustration of the number now interested in storage battery application, and the audience listened with close attention to Mr. Appleton's record of the triumphant way in which the storage battery has vindicated the faith of its friends through years of doubt and opposition. The lecture, which was of exceptional interest throughout, was illustrated by a large number of lantern slides.

After the discussion, in which Mr. R. P. Bolton, Mr. Frank J. Sprague and Mr. C. O. Mailloux took part, the company visited the storage battery power sub-station of the Metropolitan Street Railway Co., at the foot of West Twenty-third street, where was seen in operation the large railroad battery of the company, equipped with all the modern appurtenances.

The following members were elected at the meeting:

Arthur D. Dunn, E. E., No. 164 East Eleventh street, New York City.

Harvey E. Moll, No. 29 Broadway, New York City.

James A. Stiles, No. 120 Liberty street, City.

Henry I. Lurye, No. 110 East One Hundred and Ninth street, New York City.

Walter S. Wilson, No. 111 Fifth avenue, New York City.

A. Hanber, No. 15 Cortlandt Street, New York City.

Eugene F. Roeber, Ph. D., No. 210 West Fourth street, New York City.

Herbert Jenkins, No. 15 Cortlandt street, city.

George V. Flynn, No. 26 Thamas street, New York City.

Arthur Dimmant, No. 4 East Ninety-seventh street, New York City.

BUSINESS NEWS.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING JAN. 10, 1899, $117,774.

New York, Jan. 10, 1899.--The following exports of electrical material are from the port of New York for the week ending this date:

Antwerp.—Sixteen packages electrical material, $1,751.

Argentine Republic.—Two hundred and thirty-four packages electrical machinery, $11,421; 1 case electrical machinery, $296.

British Possessions in Africa.—Two packages electrical material, $10.

Bremen.—Eight cases electrical material, $1,250.

British West Indies.—Two thousand four hundred and seventy-five cases electrical material, $11,521; 1 case electros, $8; 1 case whips, $12.

Berlin.—Twenty-eight packages electrical material, $1,635; 2 cases electrical machinery, $800.

Brazil.—Twenty packages electrical machinery, $665; 32 cases electrical material, $861.

British East Indies.—Twenty cases electrical material, $2,337; 10 packages electrical machinery, $2,134.

Boulogne.—Five cases electrical material, $71.

British Australia —Four cases electrical material, $45.

China.—Seven cases electrical machinery. $300.

Cuba.—Fifty-three cases electrical material, $1,280.

Chili.—Eleven cases electrical material, $220.

Dublin.—One package electrical material, $65.

Hamburg.—One hundred and twelve packages electrical material, $5,809.

Hull.—Thirty-eighth cases electrical machinery, $7,914; 31 packages electrical material, $818.

Havre.—Two cases electros, $90; 78 cases electrical machinery, $8,199; 8 cases electrical material, $120.

Japan.—Six packages electrical machinery, $740; 87 cases electrical material, $3,940.

Leith.—Ten cases electrical motor, $563.

London.—Two hundred and thirty-four packages electrical material, $11,711; 42 cases electrical machinery, $2,000.

Liverpool.—Seventy-eight packages electrical material, $3,905; 78 cases electrical machinery, $7,140; 4 packages electric motors, $2,571; 1 case electrical material, $45.

Mexico.—Three packages electrical material, $120.

Marseilles.—Twenty cases electrical material, $2,400.

Oporto.—Four cases electrical material, $101.

Peru.—Six cases electrical material, $48.

Rotterdam.—Five cases electrical material, $250.

Southampton.—Forty-five cases electrical machinery, $1,020; 4 cases electrical material, $86; 1 case electros, $15.

Siam.—Two cases electrical material, $90.

United States Colombia.—Fifty-two packages electrical material, $1,516.

Uruguay.—Three cases electrical material, $77.

Venezuela.—Sixty-eight packages electrical material, $1,752.

Warwick.—Two packages electrical material, $52.

TELEPHONE CALLS.

Washington, Ohio.—The Citizens' Telephone Co. has increased its capital from $20,000 to $30,000.

Augusta, Ky.—The Augusta Telephone Co. has been incorporated by T. S. Bradford and others. Capital stock, $5,000.

Owensboro, Ky.—The Green River Telephone & Telegraph Co. has been incorporated with J. H. Hickman, president and treasurer, and H. K. Cole, vice-president and general manager; to construct a telephone line from Owensboro to Henderson and other points.

Fayette, Mo.—The Fayette Telephone Co. has been incorporated by C. E. Betts, H. K. Givens, C. E. Givens and others. Capital stock, $10,000.

Elkins, W. Va.—The Woodford Telephone Co. has been incorporated by J. M. Woodford, H. R. Warfield and others. Capital stock, $15,000.

Columbus, Ohio.—The Cleveland Telephone Co. has increased its capital stock from $2,000 to $3,000,000.

Lakeland, Minn.—The Interstate Telephone and Telegraph Co. has been incorporated by Robert H. McCoy, Frederick W. Epley, Albert T. Presson, William J. Johnson and Harry L. North. Capital stock, $10,000.

Kinsley, Kan.—The Kinsley Automatic Telephone Co. has been incorporated by C. B. Knowles, George W. Watson, W. F. Watson, A. F. Aderhold and T. E. Aderhold. Capital stock, $2,000.

Topeka, Kan.—The Popular Telephone Co. has been incorporated by E. F. Ware, Webster Wilder and D. E. Palmer. Capital stock, $1,000,000.

Wilson, N. Y.—Wilson Telephone Co. has been incorporated by W. N. Harris, A. N. Dwight, G. Wadsworth and J. P. Tenbrook. Capital stock, $2,000.

McLeansboro, Ill.—McLeansboro Telephone Co. has been incorporated by F. H. Stamper, R. A. Youngblood and G. C. Coutrell. Capital stock, $10,000.

NEW INCORPORATIONS.

Newport, N. Y.—Newport Electric Light and Power Co. has been incorporated by William D. Grant, B. K. Brown and Henry H. Dexter. Capital stock, $15,000.

Sherman, N. Y.—Sherman Electric Light Co. has been incorporated by Charles E. Cobb, F. D. Cornish, Charles H. Corbett, Thomas J. Newell and others. Capital stock, $5,000.

Trenton, N. J.—The Minneapolis General Electric Co. has been incorporated by Henry Schoenberr, Thomas S. Kingman, George W. Mark, Frederick W. Garvin and others; to manufacture and distribute electricity, light, heat and power. Capital stock, $2,100,000.

Henderson, Tenn.—Electric Light Co., incorporated by T. B. Hardmann, N. J. Ozier and others; electric light plant. Capital stock, $1,500.

Baltimore, Md.—The Westrom Manufacturing and Light Co. has been incorporated by F. C. Latrope, H. M. Denison, C. M. Hutton, J. O. Morris, G. B. Baker and Peter Tome; to manufacture electrical machinery. Capital stock, $27,155.

Waco, Tex.—Hill Bros. & Co. has been incorporated by B. H. Hill, N. S. Hill and E. Phillips; to engage in a general plumbing and electrical supply business. Capital stock, $10,000.

Springfield, Ill.—Sangamo Electric Co. has been incorporated by T. F. Sheridan, T. B. McGregor, and F. G. Houser; to maintain or manufacture electrical appliances. Capital stock, $10,000.

New York, N. Y.—United Electric Co., incorporated under the laws of West Virginia, by W. E. Sheffield, P. K. Green and others; to manufacture dynamos, motors, etc. Capital stock, $1,000.

Buffalo, N. Y.—New York Electric Machine Co., incorporated by J. Tate, F. Wardwell, T. E. King. Capital stock, $10,000.

POSSIBLE INSTALLATIONS.

Salisbury, N. C.—The Mayor may give information concerning electric light plant.

Orangeburg, S. C.—T. M. Rysor may give information concerning electric lighting plant.

Curley, Ala.—J. W. Roberts contemplates the establishment of a small electric light plant.

FLASHES.

Philadelphia, Pa.—Charles Wirt, electrical engineer, damaged by fire.

BUSINESS CHANGES.

Chicago, Ill.—Belmont Gas and Electric Fixture Manufacturing Co. has assigned. Liabilities and assets each $1,000.

Chicago, Ill.—F. A. Gist, electric goods; gave chattel mortgage for $302.

Trenton, N. J.—The Bergen County Gaslight Co., and the Englewood Electric Light Co. have been consolidated into the Englewood Gas and Electric Co., with an authorized capital of $400,000.

STREET RAILWAY NEWS.

Trenton, N. J.—The Trenton and Princeton Traction Co. has been incorporated by George O. Vanderbilt, Charles W. Ship-

pee, Julius Garst and others; to build an electric railroad between this city and Princeton, nine miles distant. Capital stock, $200,000.

Cleveland, Ohio.—The Cleveland and Warren Street Railroad Co. has been incorporated by M. Dodge, C. E. Thorp, J. B. Caslett, J. E. Phelps and C. B. Lockwood; to operate an electric road. Capital stock, $10.000.

Warren, Ohio.—S. A. Thrope and others have formed a company to build an electric railway connecting Warren with a Cleveland line.

Syracuse, N. Y.—The East Side Traction Co. has been incorporated by William G. Tracy, George D. Chapman, C. M. Warner, F. M. Bouta and others; to operate an electrical road eighteen miles long in Syracuse. Capital stock, $400,000.

JOTTINGS.

THE COLUMBIA PHONOGRAPH CO. gave an exhibition of its latest talking machine, the Graphophone Grand, before a number of invited guests at the Waldorf-Astoria on Jan. 10, which was highly successful.

Applications were made to the Board of Railroad Commissioners of the State by the Metropolitan Traction Co. and the Broadway and Seventh Avenue Railroad Co. for the approval of either electricity, supplied by an underground current, storage battery, or by motors operated by compressed air, upon the following streets and avenues: From the intersection of Lexington avenue and Ninety-sixth street; thence through, upon and along Ninety-sixth street to First avenue, thence through and along Ninety-third street to Avenue A, and along Avenue A to a point near the entrance to the Astoria Ferry; also upon Third street and Fourth street, between West Broadway and Wooster street.

MR. HENRY L. SHIPPY, the well-known New York manager of the J. A. Roebling's Sons Co., 117 Liberty street, is sending out a handy vest pocket diary for 1899, being one of the most convenient of its kind received.

MR. ERNEST A. LOWE has resigned his position as manager for J. Jones & Son, the well-known electrical supply house of 64 Cortlandt street.

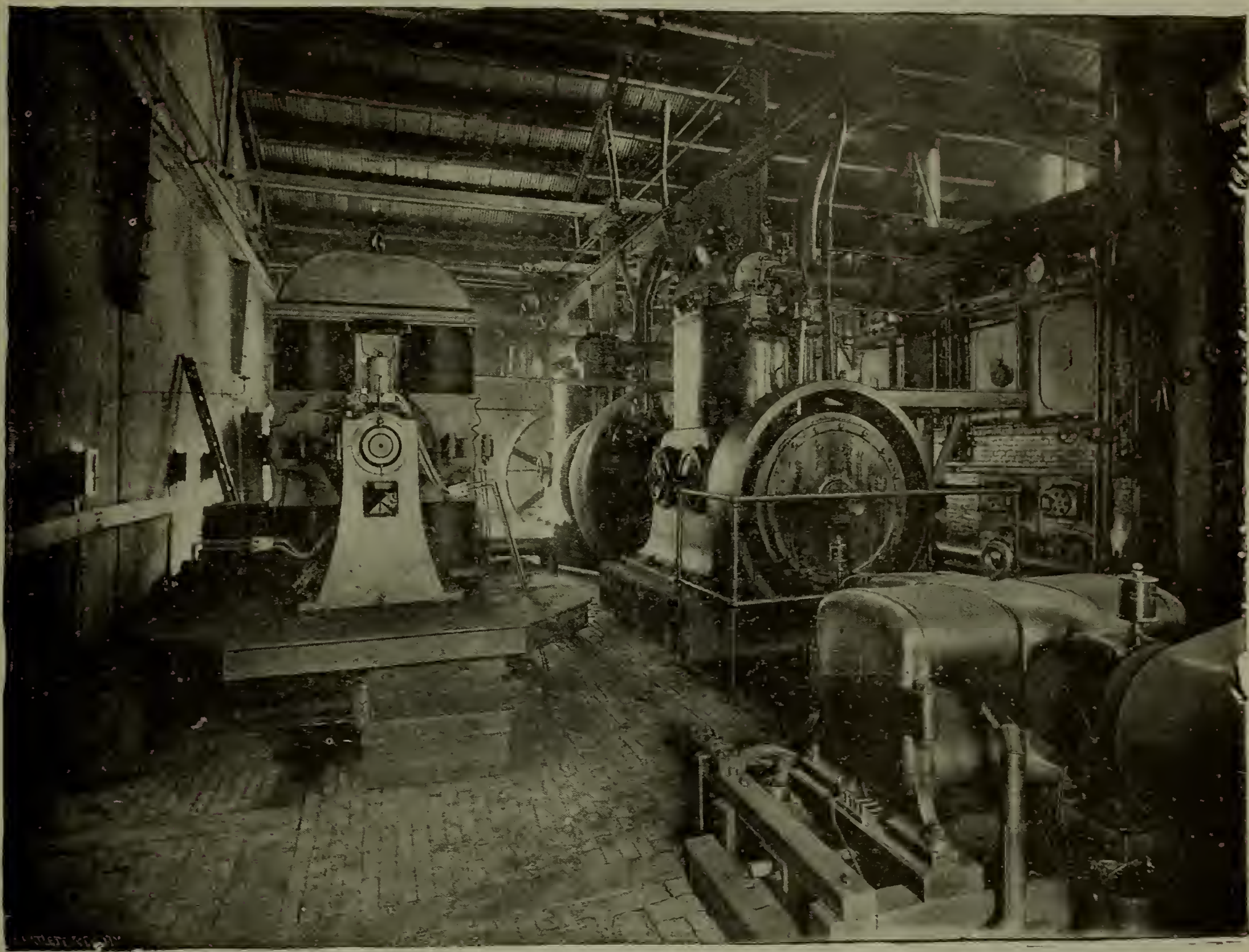
THE SAFETY INSULATED WIRE AND CABLE CO., Leonard F. Requa, general manager, factory and salesroom at 225-237 West Twenty-eighth street, are working day and night to complete the big Philippine Islands cable. They lately received the contract for this cable from the United States Government. The cable will be two hundred miles long, and will complete telegraphic communication between all the islands in the Philippine group. An immense reel, operated by steam from the interior of the Safety Company's building, has been erected in the street, upon which each length, as soon as completed, is reeled and shipped away to our latest territorial acquisition. It affords us great pleasure to make special mention of this order received by the Safety Co. from the Government.

THE AMERICAN ELECTRICAL NOVELTY CO., of 353 Broadway, we are informed, have brought suit against the Acme Electric Co., 1659 Broadway, for infringing upon their famous electric torch. It seems that several concerns are trying to reap the profits of this torch, the extraordinary demand for which has been created by the American Electrical Novelty Co., and the company has adopted stringent measures against these offenders.

The Electrical Age.

VOL. XXIII—No. 4 NEW YORK, JANUARY 28, 1899 WHOLE No. 611

ELECTRIC LIGHT AND POWER.

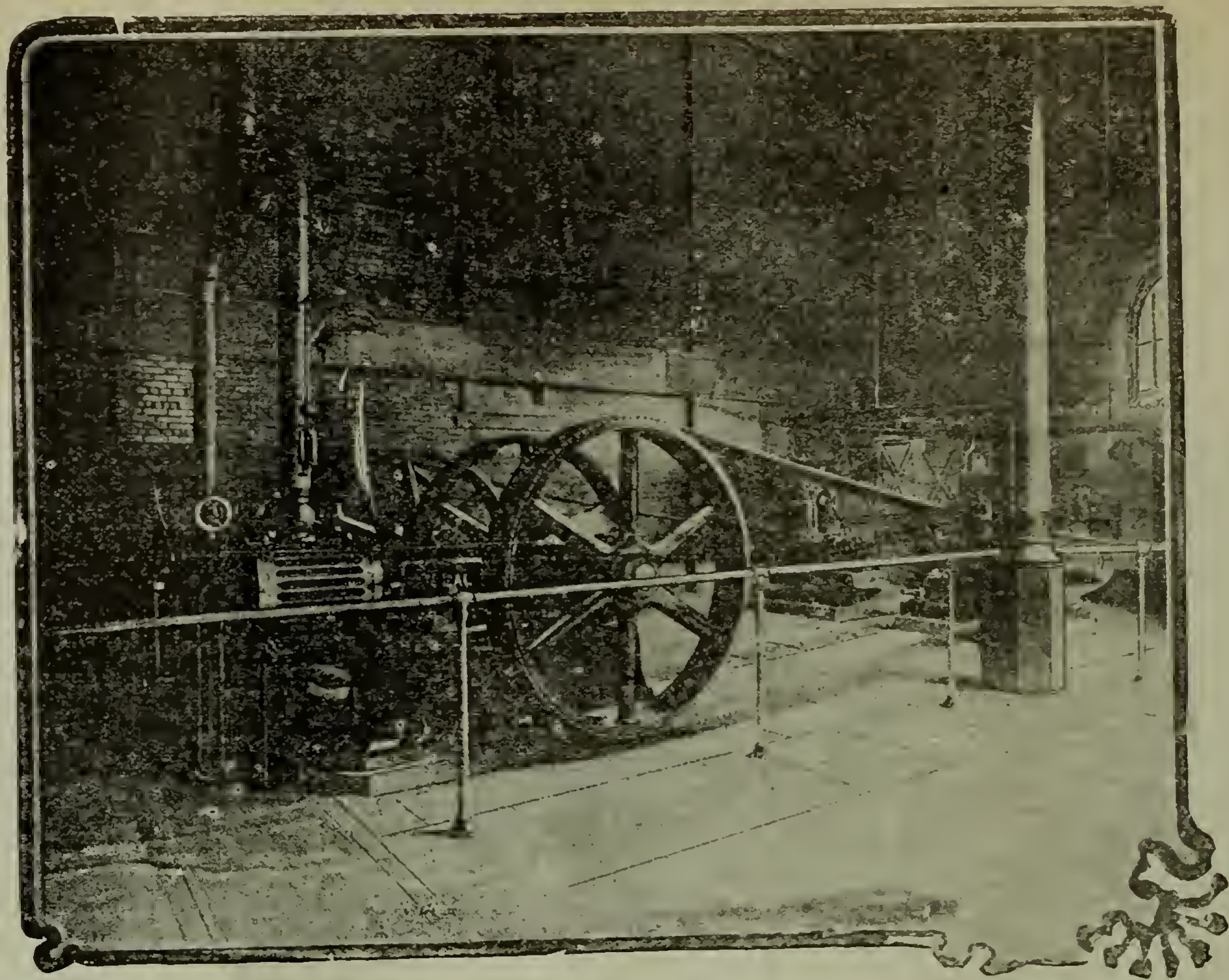


Plant showing operation of several units.

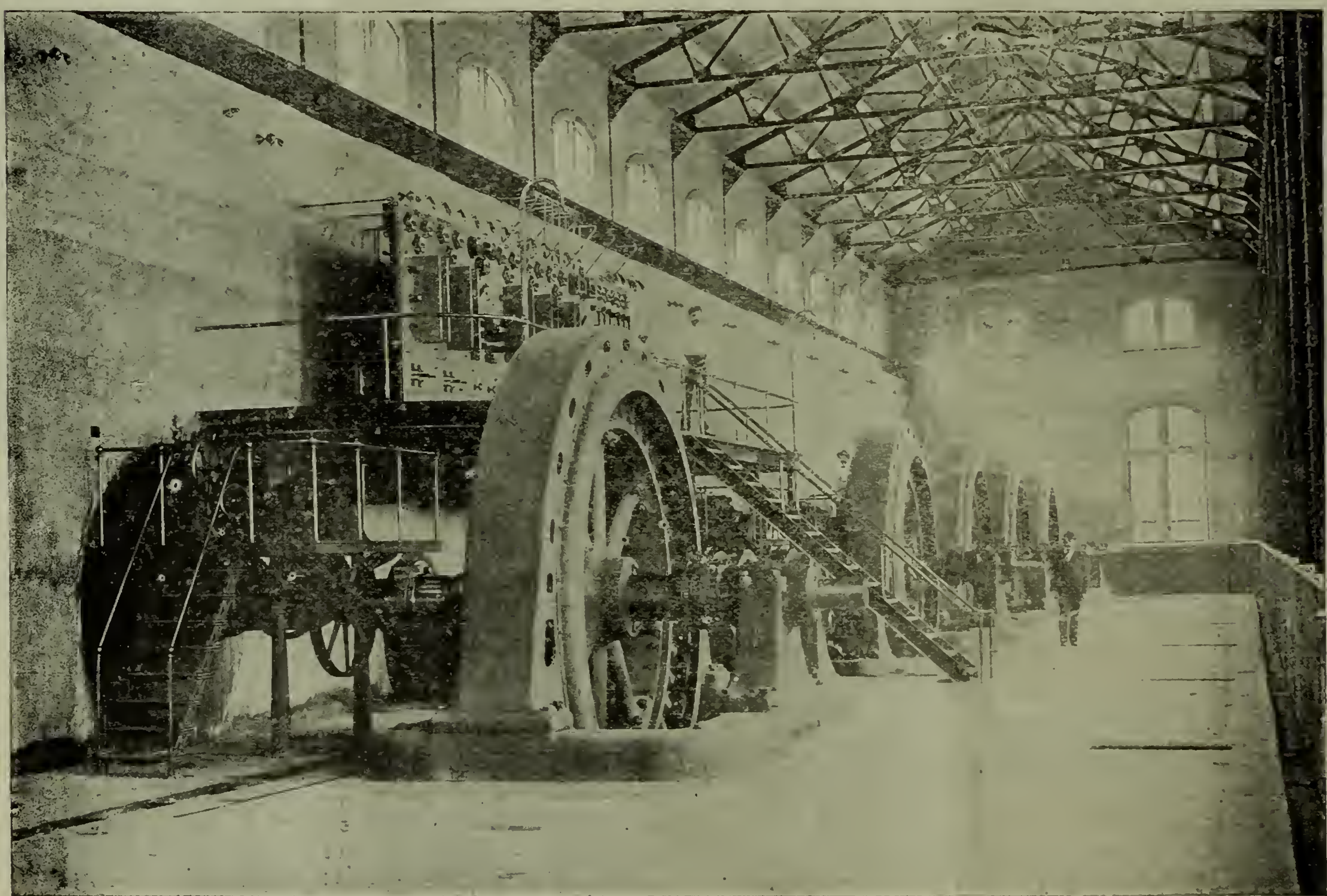
ELECTRIC LIGHT AND POWER PLANTS OF THE LAST DECADE.

Certain changes in systems of electric lighting and power distribution have brought about corresponding changes in the machinery utilized for these purposes. One of the most notable features of up-to-date practice is the employment of new and improved safety appliances. As a rule, the cruder the machinery the less the attention paid to the safety of those handling it, but when it has been sufficiently developed to be comparatively complete, able to fulfill its functions with little or no care, then the eye of the engineer is turned to the care and safety of employees, or such as may be forced to handle parts of the machines more or less dangerous. As a proof that accidents have all but ceased to occur newspaper reports on the subject are few and far between and plants developing thousands of horse power at death dealing pressures have become one of the most remarkable features of modern installations. The Edison Illuminating Co., at one time the exponent of continuous

current transmission and distribution, are now generating within their station a pressure of 6,000 volts. This current is polyphase, and is sent out to relieve the strain on a distant station. The ease of pliability exhibited by the electric current is solely due to the introduction and adoption of polyphase apparatus as a permanent element of electric light and power work. In the illustrations a variety of plants are shown; continuous current and alter-



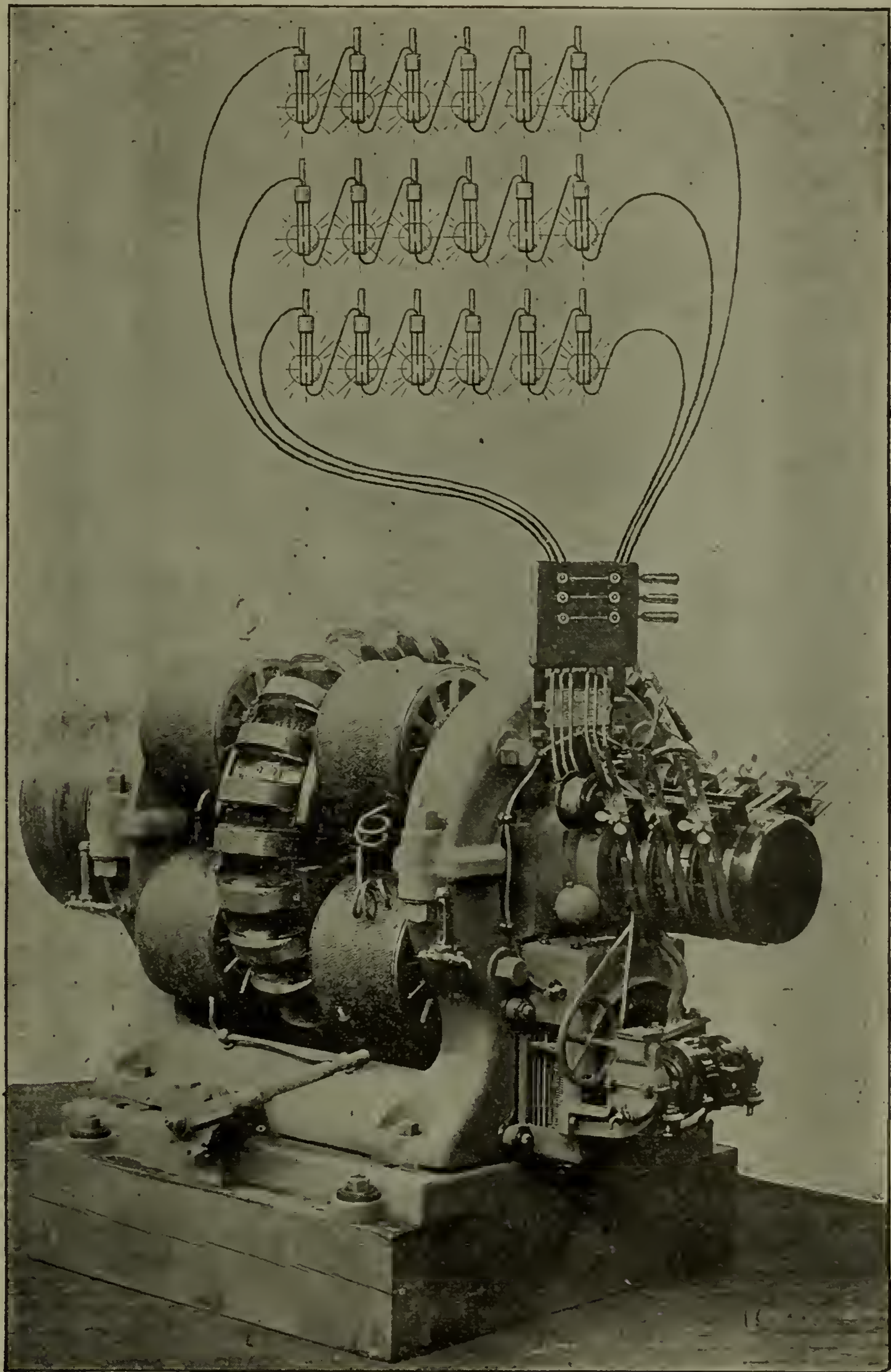
Model Plant, Link Belting.



Modern Transmission Plant.

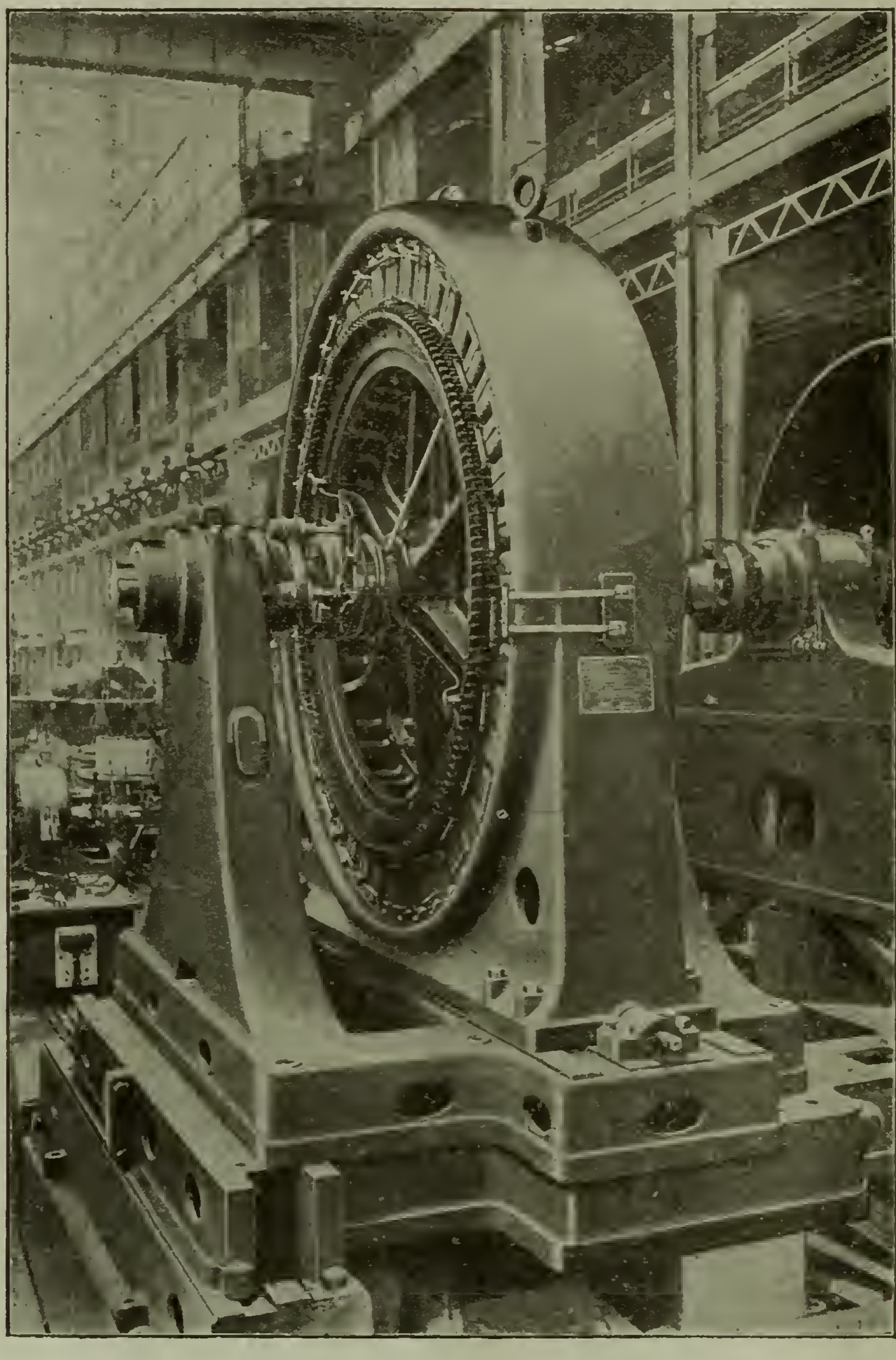
nating, old and new. A modern plant, strange to say, is generally one containing alternating current machinery, whereas ten years ago neither rule nor record existed to prove or even to indicate which would serve most satisfactorily in a given case, the alternator or the low-pressure dynamo. Even the arc light machine has undergone modifications that stamp it with the progress of the times. High pressure lines within the city's limits have been practically forbidden within the space of time above mentioned. The difficulty of constructing an arc light machine of, say, 6,000 volts, made the further improvement of this system along those lines one full of insuperable difficulties. The Brush Arc Light Co. designed and constructed a dynamo able to feed 120 arc lamps without employing a pressure of 6,000 volts. This machine is called a multi-circuit dynamo. The armature is wound with three separate and carefully insulated circuits, each ending in its own commutator and brushes. Each set of windings develops 2,000 volts. When the three sets of windings are connected to three separate arc light circuits of forty lamps a piece, the machine is fully loaded, is only generating 2,000 volts in each circuit, but is supplying in all a total of 120 lamps, each receiving the full quota of pressure and current. This machine involves the principle of three generators in one, but although its capacity is very high, this new method of sub-dividing pressure makes it much more acceptable to station proprietors for arc lighting than the old-fashioned type of machine.

The alternator has undergone many modifications which have given it a new place in the station. The single phase alternator has, to a large extent, disappeared, and in its place we find the newer, better, and in many cases, the simpler form of polyphase generator. Aside from the question of power transmission, the polyphase generator is not as difficult to construct as a multipolar, continuous current generator. It is not as expensive because it has no commutator, and it is not as difficult to run or take care of, because it never sparks. In fact, a well-made two or three phase dynamo represents the beau ideal of machines. Its current, when sent into a two or three phase motor, starts it immediately, without the necessity



Multi-Circuit Brush Arc Dynamo. 3-circuits of 2,000 volts.

for observing care in starting it up, to a large extent with the risk of burning it out under such circumstances. It may be truly said that the most modern of plants would be one in which the polyphase current is generated. The most modern of transmission lines and the cheapest would be one carrying a polyphase current, and as far as the knowledge of the electrical engineer extends the polyphase motor is certainly on a par with the average continuous current motor and superior to it on acount of its greater simplicity of construction. Switches and switchboards carrying from 1,000 to 2,000 volts, have been highly improved by several corporations handling this class of machinery. As far as the switch is concerned, it has been so cunningly designed that the circuit is broken when the alternating current wave is at its lowest point, and the switchboard made of carefully selected marble, supplied with synchronizer, ground detector and measuring instruments, leaves nothing to be desired. To conclude, we quote as follows from the "Engineering Magazine" of the greatest advocates of alternating current generation and distribution in the United States: "The polyphase alternating current system is to-day the most successful organization of electrical apparatus for the distribution of light and power from a central station. That the users of electrical machinery know this to be true is demonstrated by the fact that for almost every new central station polyphase generators are selected, while many plants that have been established and in commercial operation for years have begun to substitute polyphase for single phase machinery.



Latest Type of Polyphase Alternator.

LOVE PUT OUT THE LIGHT.

The North Shore Power Co., of Canada, which is supplying electricity for the city of Three Rivers, is generating it at Batiscan Chute and stepping it up to 12,000 volts for the purpose of a sixteen-mile transmission. A few evenings ago, says the "Canadian Engineer," just as the dusk was coming on and the heavy load beginning to show on the ampere meters, the circuit breakers flew, the fuses blew and the lights were out. This lasted for perhaps ten minutes, when the lights again started up and ran satisfactorily The day following the electrician naturally investigated to see what caused the trouble, and he found that a window had been broken in the sub-station at Three Rivers, and that some of Jean Baptiste's chickens had sought a roost on the bare copper wire, and as Chanticleer kissed Biddie "good night" it completed the circuit, electrocuted the lovers and put the lights out. This, perhaps, is one of the most uncommon short circuits or reasons for trouble that has occurred in Canada, and is a pointer for other electricians who may have power houses with broken window panes.

The Electrical Age.

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NEW YORK, JANUARY 28, 1899.

CONTENTS:

ATMOSPHERIC ELECTRICITY.

The noted scientist, philosopher and statesman, Benjamin Franklin, was not fully aware of the risk he was running when he elevated his kite on that famous occasion which brought about the identification of lightning and electricity. Franklin himself, in some correspondence of his, states as follows: "To determine the question whether the clouds that contain lightning are electrified or not, I would propose an experiment to be tried where it can be done conveniently. On the top of some high tower or steeple place a kind of sentry box, big enough to contain a man and an electrical stand. From the middle of the stand let an iron rod rise and pass, bending out of the door, and then upright twenty feet or thirty feet, pointed very sharp at the end. If the electrical stand be kept clean and dry, a man standing on it, when such clouds are passing low, might be electrified and afford sparks, the rod drawing them to him from a cloud.

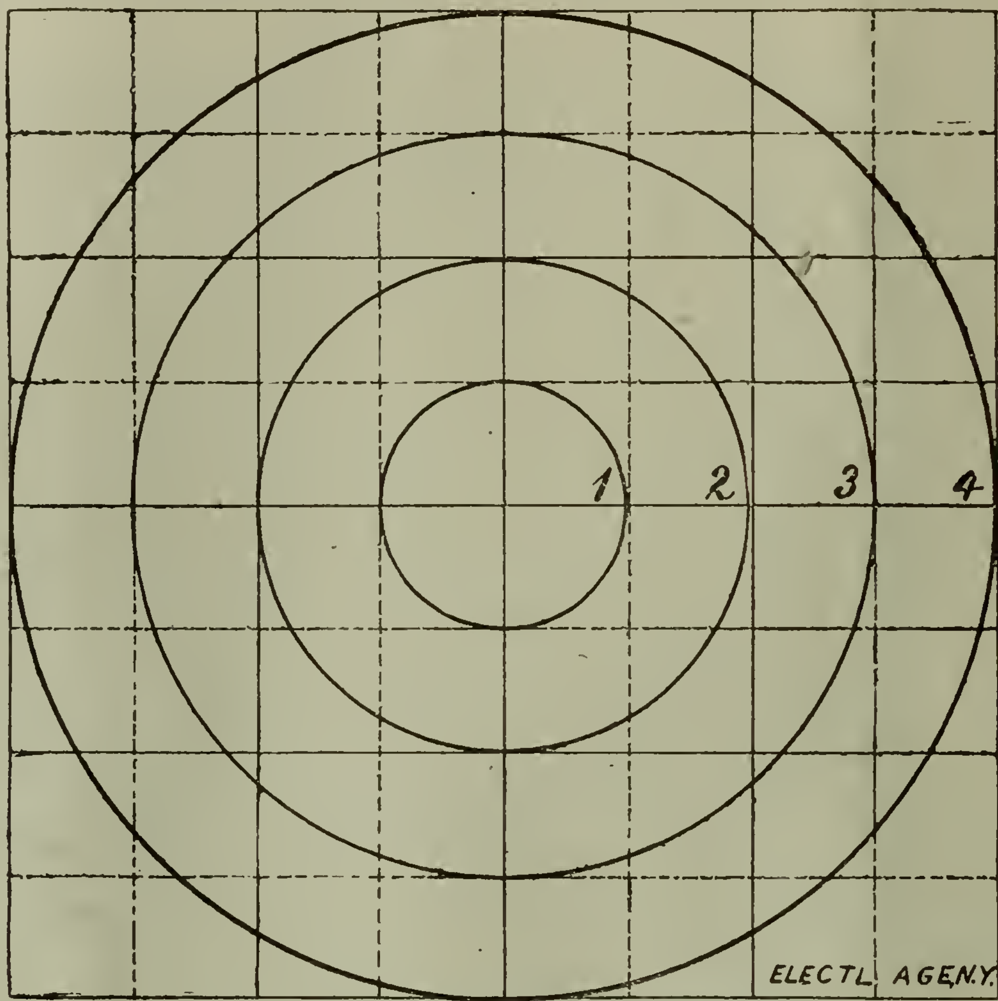
If any danger to the man should be apprehended (though I think there would be none) let him stand on the floor of this box and now and then bring near to the rod the loop of a wire that has one end fastened to the leads, he holding it by a wax handle, so the sparks, if the rod is electrified, will strike from the rod to the wire and not affect him." It might be of interest to the public to know that Franklin was an LL.D. and F. R. S., great titles in those days. In consequence of his high scientific standing his word was law but there are few men to-day who would care to risk destruction in a similar manner. G. R. Richman in 1753 was killed under exactly the same circumstances that left Franklin free and unhurt. As to the cause of atmospheric electricity, certain opinions are rife possessing more or less scientific value. But the earth itself is charged with electricity. By means of an electrometer the negatively electrified condition of the terrestrial sphere can be repeatedly shown. It is as difficult a problem to decide from whence springs the electricity in the air, as to account for that produced in the atmosphere. Prof. Arthur Schuster, F. R. S., remarks: "Observations which may be made every day and at every place have shown that the earth is electrified, whatever the weather may be. In the language of the older theory, which we cannot as yet altogether abandon, we say that the earth is covered with negative electricity or, in modern phraseology, we express the same idea by the statement, that we move about in an electrified field, that electric lines of force stretch through the air from the ground, from our bodies, and from everything which is exposed to the sky overhead. The strength of this electric field is not at all insignificent. If we wish to produce it artificially between two parallel plates kept at a distance of one foot, we should have to apply an electro motive force sufficient and sometimes more than sufficient to light up the incandescent lamps which illuminate our dwellings. The electric force is comparatively weak in our country (England) but fifty volts per foot are constantly observed and one hundred volts are not uncommon; but in dryer climates the amount of the force may be considerably in excess of these figures.

If we fix our minds on the lines of force starting from the surface of the earth, we are at once led to ask what is their other end? Do they curve round and back again to earth? Do they end in the dust which everywhere surrounds us or do they reach up to the clouds? Do they pass through the clouds and end where invisible particles separate the sunset red from the midday blue? Or finally do they leave the earth altogether and form intangible bonds between us and the sun, the stars, the infinity of space? These are not idle questions and we cannot be said to have solved our problem unless some definite answer is given to them. The last mentioned view, propounded originally by Peltier, and latterly supported by Exner, is the simplest. If we could allow that the earth once electrified negatively could remain electrified forever, the corresponding positive electrification being outside our atmosphere altogether, the chief difficulty of atmospheric electricity would be removed and the normal fall of potential at the surface would be explained by the permanent negative electrification of the surface.". These conclusions or rather opinions written by the pen of an able scientist, are worthy of careful consideration by thoughtful men. Possibly, no abnormal condition at the surface of the earth is more remarkable than that of its electrification and it seems likely on account of its continuance, slight variability and permanence that some great cause is at work through which the atmosphere is always charged positively. Whatever the reason may be, it would no doubt be of the greatest interest and possibly be the means of greatly assisting us in our hunt for things still further hidden behind the veil.

ELECTRO-TECHNICS.

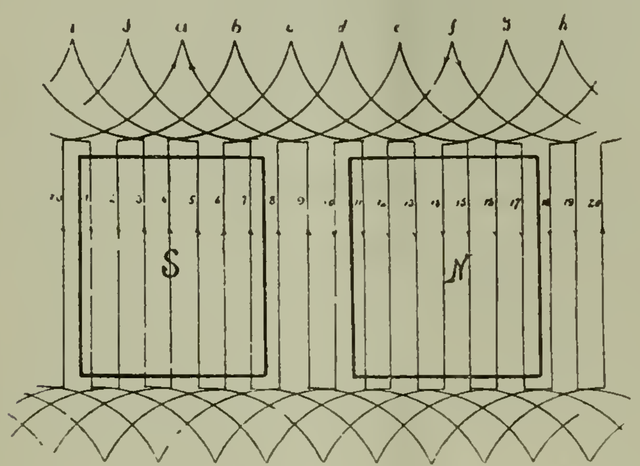
TECHNICAL NOTES.

The dynamo or motor essentially consists of an armature and field. Commutation is merely a necessity due to the alternating nature of the current developed. The strength of field exercises so great an influence over the conditions under which a dynamo or motor run that un-



Iron Core With Different Depths of Winding.

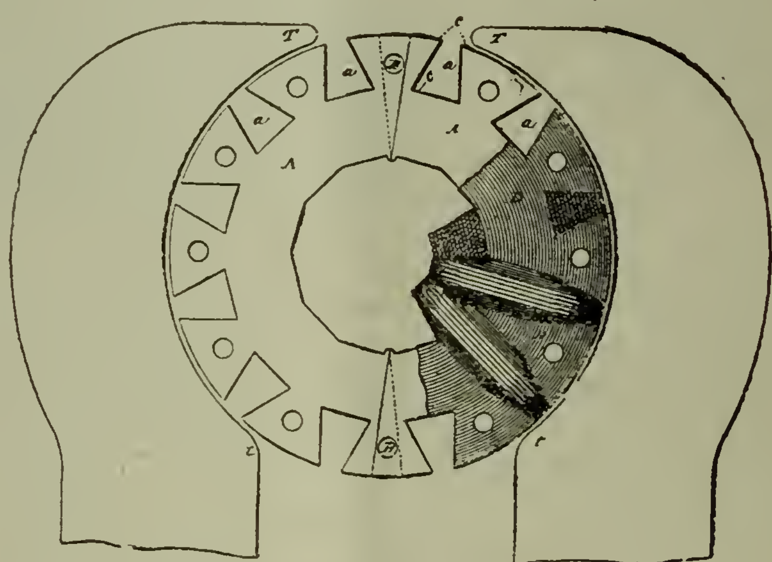
less strict attention be paid to its design, as regards intensity and flux, serious troubles may arise. On the other hand, the armature, by its winding, and if toothed, by the shape of such teeth, also calls for considerable detailed attention. Certain questions relating to the field are of the utmost consequence. The diameter of the core



Wave Winding.

and length of core naturally govern the cylindrical surface upon which wire may be wound. In view of this fact, a shallow winding would mean one in which the radiation was almost as great for the last layer of wire as for the first. In consequence of this, the temperature developed may be very moderate. If the depth of winding is considerable, the inner layer of wire has less radiating surface than the outer, the temperature within the coil near the core would be very high. The illustration shows various depths of winding, one inch, two inches and three inches deep, surrounding a core one inch in diameter. An allowance of two square inches per watt on the outside of the coil will mean freedom from high temperatures, otherwise the coil will run hot and the inside layers may burn out.

Toothed armature cores have been generally adopted on account of the great advantages their use imply. In the sketches the closing in of the lines of force around a piece of iron placed in a magnetic field, the varieties of teeth employed, and the manner of placing wire within them thus, is clearly shown. An iron tooth may run very

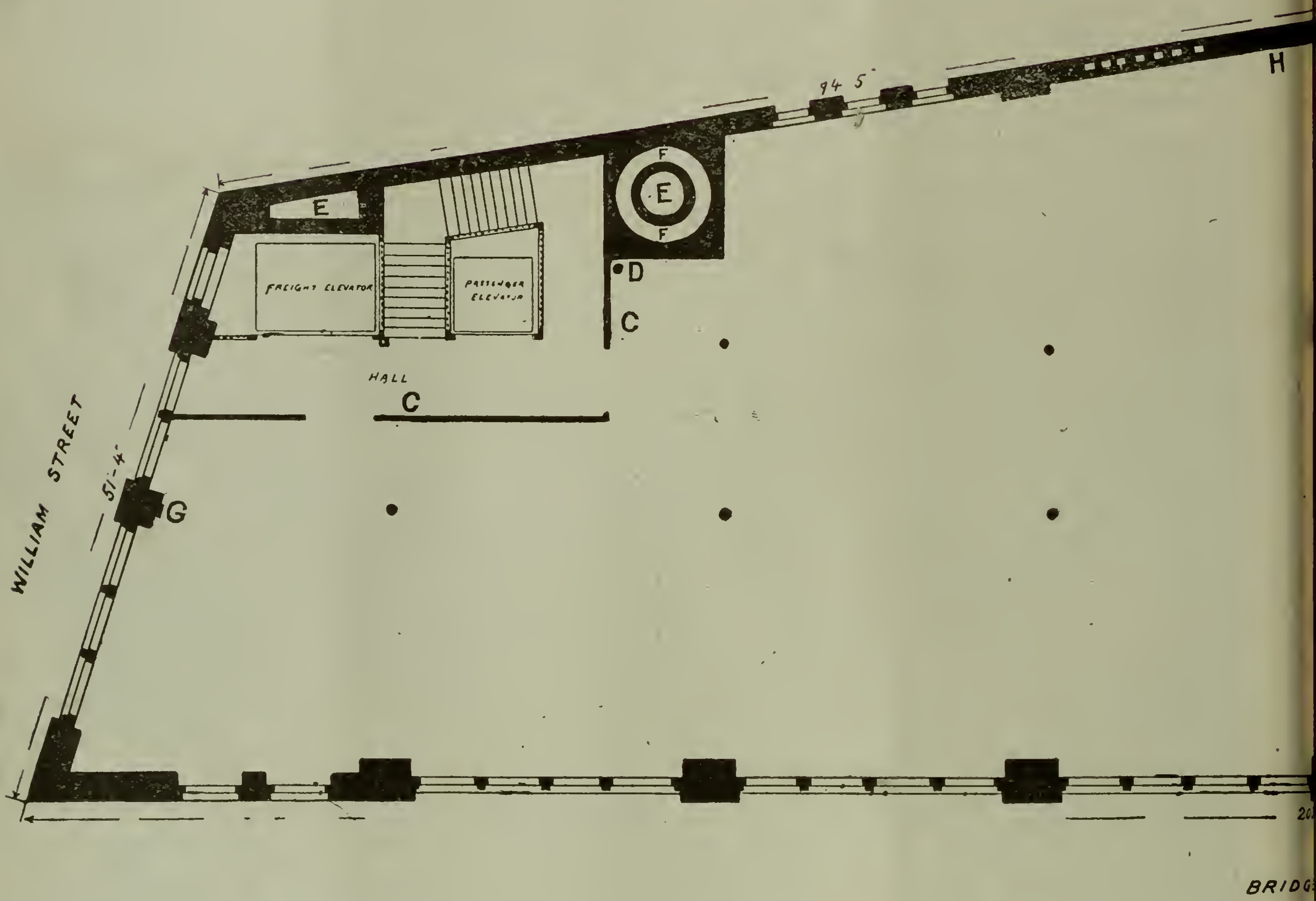


Trapezoidal Teeth With Winding.

close to the pole face, gather in the lines of force on account of its high permeability, and thereby save copper on the fields. The air gap filled with wrought iron in this manner means a saving of considerable money in the actual manufacture of dynamos or motors. The point

METROPOLITAN REALTY BUILDING,

214, 216, 218 William St. and 18-20 Rose St.



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10th and 12

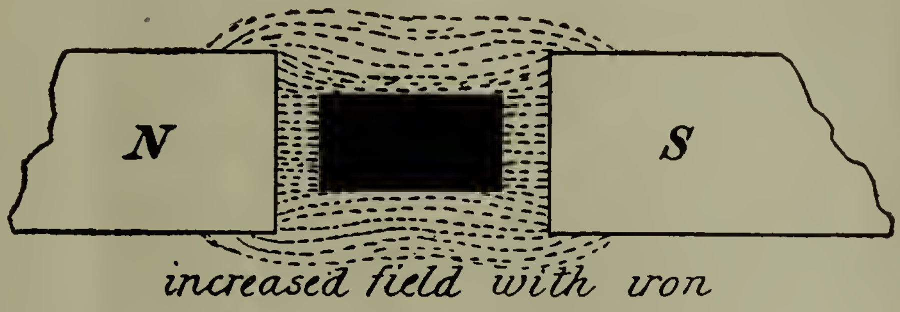
of greatest interest is the relation that must exist between the air gap, width of slot and intensity of the field. The air gap should be from one-quarter to one-third of the width of the slot. The intensity of the magnetic field should not exceed 40,000 lines of force per square inch. The cross section at the base of the tooth should be great enough to admit the lines of force entering without unduly crowding them.

MISCELLANEOUS SCIENCE.

STRAY CURRENTS.

THAWING FROZEN GROUND BY ELECTRICITY.

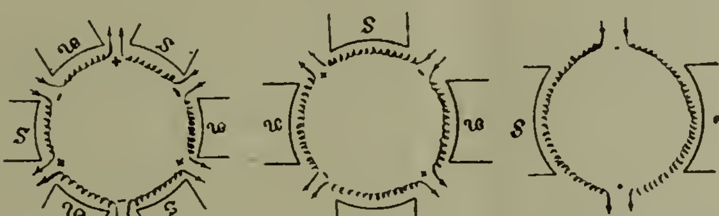
Mr. Nelson Graburn, electrical engineer of the Montreal Street Railway Co.,has obtained a patent for a process of thawing frozen earth by the passage of a current of



The difference between bi-polar and multi-polar machines is well illustrated in the sketch shown. Commutation merely operates selectively by picking up all impulses in one direction as systematically as they are gathered up and then reversed. The winding of a two-pole and a four-pole machine may be included under two heads. First, lap winding; second, wave winding. A bi-polar machine, with wave winding, is rarely employed; as a general rule lap winding is considered most convenient. A multi-polar, a six-pole machine, would have as many brushes as poles if lap wound, but would only have

Types of Teeth.

one positive and one negative brush if wave wound, although it must be understood that combinations are effected whereby more than two and less than six brushes are all that is necessary. One of the best authorities on this subject is Silvanus P. Thompson, author of "Dynamo Electric Machinery." The complete design of the dynamo depends largely upon a careful consideration of the armature, so far as its winding and teeth are concerned, as



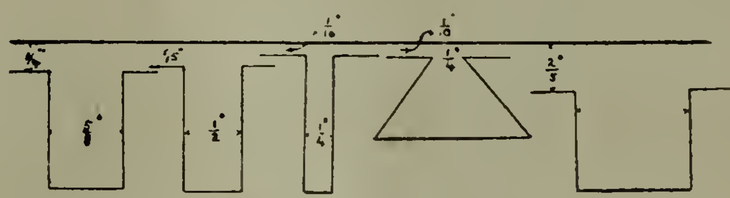
Direction of flow in bi-polar and multi-polar machines.

well as certain other little points, which gradually develop themselves as the design proceeds. It is a good idea to realize that an armature is merely a revolving electromagnet composed of a series of separate coils, whose temperature depends upon the speed with which they move through the air and their radiating surface. If 1,000 circular mills per ampere are allowed in the field winding at least 500 circular mils per ampere must be allowed for the armature winding. If a radiating surface of two square inches per watt is allowed for the field winding, at least one and one-half square inches must be allowed for the radiating surface of the armature winding.

electricity. A syndicate with a capital of $125,000 has been formed in London to exploit the process in the mining regions of the Klondike. The plan is to use the heat of a resisted electric current, instead of bonfires or heated boulders, in the shaft to thaw the ground. By this electric system it is claimed that almost all the heat energy can be applied just where it is required, without the great loss consequent upon other methods by radiation.—Western Electrician.

THE VELOCITY OF CATHODE RAYS.

The latest in French science is as follows: The veloc-

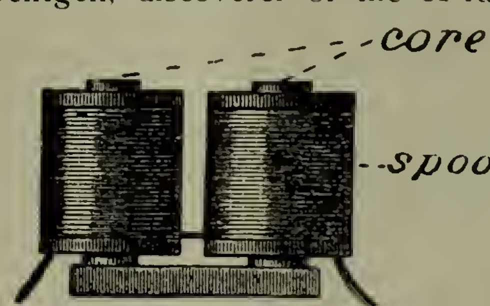


Ratios of air gap to teeth.

ity of the cathode rays may have any value between one-fifth and one-tenth of that of ordinary light, and the particles supporting the electric charges are only one-thousandth part of the size of a molecule of hydrogen. The italics are ours. We merely remark that the molecule of hydrogen only consists of two atoms of that element. —Ex.

PROF. ROENTGEN.

Prof. Roentgen, discoverer of the X-rays, has been



Coil built for lifting.

called to the Chair of Physics at the University of Leipsic from the University of Wurzburg.—Ex.

SMOKE CONSUMPTION.

One of the most recent appliances for smoke abatement in steam raising is an apparatus designed to regulate the admission of air to the furnace. This is effected by a series of panels which open and shut in the manner of a Venetian blind, by a cataract cylinder. The main object of the apparatus is to admit sufficient air to burn off the black smoke ,and close the air supply when this has been obtained, without letting down the steam.—Ex.

THE ELECTRIC ARC.

It is stated that the electrical properties of the vapors

from a carbon arc are similar to those of gases that have been acted on by X-rays, or to the gases from an ordinary flame.—Ex.

BOILING POINT OF LIQUID OZONE.

A paper on this subject from Mr. Louis Troost has appeared in Comptes rendus, and an abstract is given in the Journal of the Chemical Society. Ozone was liquefied in a vertical tube immersed in a bath of liquid oxygen, and the latter was then lowered until the readings of a galvanometer in circuit with a thermo-junction previously introduced into the tube were constant during the ebullition of the ozone. The boiling point of liquid ozone was thus found to be 119 degrees at the atmospheric pressure.

LIGHTNING.

A question has been addressed to the Weather Bureau to the reason why certain kinds of trees are more liable to be struck by lightning than others. The gentleman who has taken up the matter states that, from the information at present available on the subject, oak trees are most frequently damaged by lightning, while birch trees are lowest on the list. Thus, he estimates, that for every birch tree that is struck in a given time, 54 oak trees would be injured and 15 pine trees.

THE "EMERSON" ELECTRIC ORGAN PUMPING OUTFIT.

In response to inquiries covering a number of years, The Emerson Electric Manufacturing Co., of St. Louis, Mo., have recently perfected a thoroughly practical and efficient device, by means of which church organs can be operated by alternating or direct current motors.

The illustration shows the pumping outfit arranged with automatic clutch and connection to organ bellows, by which the pumping mechanism of a pipe organ is automatically regulated to supply the amount of air required.

This system is designed primarily for operation on alternating current, but its extreme simplicity, compactness and the ease with which it can be installed, recommends its use with any kind of electrical current.

The outfit shown consists of an Emerson "Single Phase" alternating current motor of 1 HP., arranged with triple worm gear to directly transform the revolutions of the motor (1,800 per minute in this case) into the reciprocal crank motion required for an organ pump (45 strokes per minute in this case).

This outfit eliminates the necessity of all pulleys, belts, countershafts, etc., and is furnished to meet the exact requirements as to length of stroke and strokes per minute which may be required to meet the necessities of various organs.

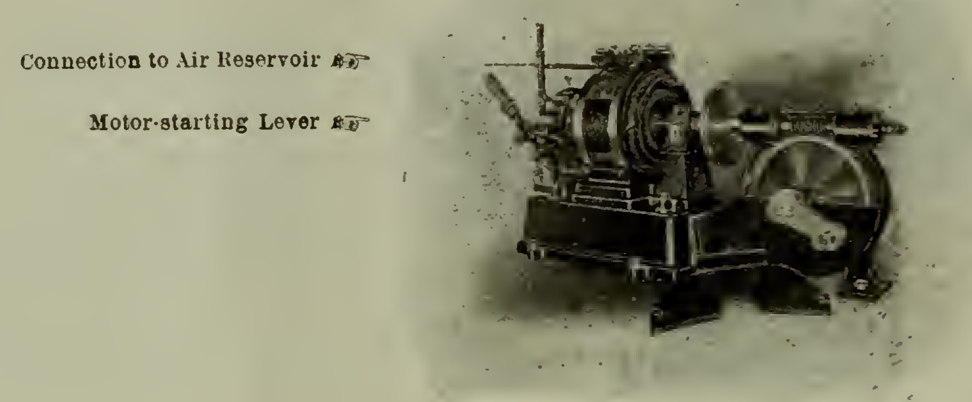
In this system the motor is started and left running (at a constant speed) while the organ is in use, and would be left running during an entire service or concert. The only disadvantage to this is the amount of current used while the pump is not in operation, and as this amounts to only 1 3-10 cents per hour on a 1 HP. motor with a rate of 10 cents per M. watts (power rates range from 5 to 20 cents per M. watts for this class of work) it will be seen is a negligible factor, and in fact is fully compensated for by the absence of extra current in starting several times.

The advantages of this system are quite numerous, the principal ones being the absence of regulating rheostats and sparking of contacts on stopping and starting, while the simplicity and compactness of the outfit speaks for itself.

The operation of this outfit is as follows: The motor is started by the handle marked "Motor Starting Handle," and as the bellows of the organ is presumably empty, the friction clutch shown at the other end of the motor shaft is in contact with worm disk and the motor begins pumping air into the air reservoir until filled. The natural rise of the top of the air reservoir to which the chain marked "Connection to Bellows" is attached through pulleys or bell-cranks will release the friction disk when filled to any desired point, and the pump mechanism will stop, leaving the motor running free, and thus taking almost no current.

As soon as the air reservoir begins to empty, this will allow the clutch to operate again and supply as much or as little air as may be necessary to keep the reservoir full or well supplied with air.

The action of the friction disks is positive and noiseless. The worm is of hardened steel. The worm wheel is run in a bath of oil and is therefore perfectly lubricated at all times, and the entire outfit is designed and manufactured in a thoroughly first-class and workmanlike manner to stand hard and continuous service with little or no attention.



"Emerson" Electric Organ Pumping Outfit.

The action of the outfit may be controlled so as to pump fast or slow, and to change speed as the air reservoir fills by merely making a spring connection between air reservoir and motor instead of solid connection, but we advise using a solid connection whenever practicable, as there is then very little or no wear on the friction clutch.

For further information, write to the Emerson Co. for catalogue 2,001.

LITERARY.

THE HOME MAGAZINE (New York), for February, will contain what promises to be one of the most remarkable magazine articles of the year, on Keeley and the Keeley motor. The author, William Mill Butler, has had access to the innermost secrets of Keeley's workshop and also to the records of the Keeley company. The result is the first authentic published account of what Keeley really accomplished.

Keeley, it will be remembered, was the man who

claimed he could develop enough energy out of a few drops of water to run the machinery of the world for a century. He experimented 25 years, made 150 different machines, spent half a million dollars, and just before his death last November, completed a working model of an engine which he said was the realization of all his dreams. A large machine is now being constructed from this model and with it Keeley's successors expect to revolutionize the industrial world.

The article is illustrated from over a dozen photographs of Keeley's different machines, none of which has ever before been published.

THE TWENTIETH ANNUAL NUMBER OF THE "TRADESMAN," Chattanooga, Tenn., presents a combination of high literary ability and mechanical get-up very rarely equalled in the annals of trade journalism. It contains articles on the prominent industries and industrial development of the South by authorities on the various topics and is invaluable for reference and as a record of the gigantic growth of the South within the past decade.

Mr. T M. St. John, the author of "How Two Boys Built Their Own Electrical Apparatus," states that his work is meeting with an exceptional demand and that he has another volume in preparation of interest to rising electricians, laid out on lines similar to his first work. His present book ought to be in the hands of all practical electricians as well as novices, as it gives all the details necessary in the building of all kinds of electrical apparatus. Copies of this book will be sent, postage prepaid, to any address, upon receipt of one dollar.

PRODUCTS OF THE ELECTRIC FURNACE.

TWO METHODS OF MANUFACTURE OF CALCIC CARBIDE.

(Extract from Cantor Lecture by Prof. Vivian B. Lewes.)

The two principal processes utilized in making calcic carbide by electrical power are the ingot process and the tapping process. In the ingot process the coke and lime are finely ground and carefully mixed in the right proportions to suit the chemical actions involved. The arc is struck in a crucible, and the powdered mixture is allowed to flow in and partially fill the crucible An ingot gradually builds up from the bottom of the crucible, the carbon electrode being raised from time to time, automatically or by hand, to suit the diminution of resistance due to the shortening of the arc by the rising ingot. The crucible is of metal and considerably larger than the ingot, the latter being surrounded by a mass of unreduced material, which protects the crucible from the intense heat. When the ingot has been made and the crucible is full, the latter is withdrawn and another substituted. The process is not continuous, but a change of crucibles takes only two or three minutes, under the best conditions, and occurs but once in every ten or fifteen hours. The essence of this process is that the coke and lime are only heated to the point of combination, and are not "boiled" after being formed. In the tapping process a fixed crucible lined with carbon is used. The electrode is nearly as big as the crucible, and a much higher current density is employed. Fine grinding is unnecessary, as combination probably only takes place after fusion of the raw materials, which mix more or less as liquids. The carbide is heated to complete liquefaction, and tapped at short intervals. There is no unreduced material, and the process is considerably simplified, whilst less expensive plant is required; but, on the other hand, the output in carbide per electrical horse-power per day is consideraby less than in the ingot process, and it is only more economical when power is comparatively cheap.

TRANSMISSION OF POWER.

ELECTRIC UTILIZATION OF WATER FALLS.

The first item of expense in electrically utilizing a water power is the amount required for water privileges. In some cases this is rather an unimportant consideration, while in others it is the chief expenditure, for it may involve the buying of thousands of acres surrounding the stream, because the necessary dams may cause to be submerged a great deal of valuable land, or large tracts have to be bought for building storage reservoirs, or the right of way for pipe lines, etc., have to be secured. When land is cheap these considerations are often not objectionable, but where good farming land, or land valuable for other reasons, has to be thrown to waste, the question may be a perplexing one.

The cost of a dam, power-house, and hydraulic machinery is, as a rule, dependent almost entirely on the characteristics of the stream being utilized. Entering into the question is the amount of water in the stream, both under normal as well as abnormal conditions, at various seasons of the year; also the head or fall, and whether it is dependent upon natural conditions or requires the building of large dams. Generally speaking, other things remaining equal, generating plants, comprising the power house, hydraulic and electric machinery, as a whole cost less as the head increases, until certain limits have been reached. When the head is low, ranging from 4 to 10 feet, it requires a comparatively large wheel for a relatively small amount of power, and then only slow speeds can be obtained. When large units are desirable, a number of such wheels must be coupled together in order to get the required power. The speed required can be raised or lowered to a certain extent, depending on the size of the wheel. If higher speeds at low heads be desired for large units, many wheels must be operated together, requiring not only a great deal of room, and consequently a larger power house ,but considerable line shafting, gears, couplings, etc., which not only increase the initial cost, but increase the cost of operation and maintenance of the plant, as well as introduce another source of inefficiency. With higher heads a larger amount of power can be obtained from fewer and smaller wheels, with higher speeds, and, therefore, cheaper generating apparatus.

The cost of generating apparatus for a given capacity, other things remaining equal, is almost directly proportional to the speed at which it runs, and for this reason it is always desirable to refrain from too low speeds whereever possible.—L. D. W. Magie, in Cassier's Magazine for February.

THE TRANSMISSION OF ELECTRIC POWER.

Prof. George Forbes delivered a lecture at the Society of Arts recently on the Long-Distance Transmission of Electric Power. The power is generated by a waterfall driving a turbine, which rotates a dynamo machine. The electric pressure might be raised by transformers, and it would then be carried by bare copper conductors or wires to a point perhaps hundreds of miles distant from the generating source. At the point of delivery the pressure would be lowered, after which the current would be passed through an electric motor, which would drive mills, pumps, hoists, stamps, at mines, or other machinery. He thought that this method of transmitting electric power would be most useful in the case of gold mines situated at a distance from water power, and was of the opinion that the power of the Victoria Falls on the Zambesi might be economically transmitted 500 miles for the development of mining in Rhodesia. He had considered plans in New Zealand and India for transmitting power 250 miles, and in some cases the miners were prepared to

pay £180 per annum for each horse power, and in many cases £100. But there were many other industries that might be benefited, such as irrigation, for example, in Egypt, and he stated that the electric lighting of Cairo could be done cheaper by power generated 400 miles away, at the First Cataract, than by steam engines in that city. A portion of the lecture was devoted to answering the difficulties which presented themselves to financial men. Electric power had never been carried to such distances as he had spoken of, but it had been carried 108 miles, with 70 per cent. of efficiency, and he presented several supposititious cases of the cost of the necessary works, showing revenues of 80, 25 and 9 per cent., respectively. In all cases the serious outlay was for copper, but he had worked out a plan whereby the 9 per cent. might be converted into 40 per cent. by mortgaging the copper required to debenture holders or copper merchants at 4 per cent., instead of paying for it out of capital. To engineers he explained some very valuable tables, which he had worked out during his long experience, for calculating currents, horse power, the quantity of copper required, and the loss of electricity during transmission.—London "Invention."

ELECTROLYSIS.

OZONE.

Ozone is used at Saint Maur, near Paris, for purifying water. Air is ozonized by the action of a current of electricity raised to a very high tension by appropriate transformers. The voltage used at the municipal works at Saint Maur, where M. Tindal superintends the purification process, which is of his own devising, is from 50,000 to 100,000. This current is used to produce a brush discharge which ozonizes the oxygen of specially dried air. The ozonized air is driven by a pump into a lofty cylindrical sterilizers of cast iron. These are divided internally into numerous stories by celluloid plates pierced with very fine holes. Hence the water, which enters the sterilizer at the top, descends slowly and in a state of fine division, thereby undergoing long and perfect contact with the ozone. The water leaves the sterilizers absolutely free from germs or microbes, as well as from all dead organic matter.—Ex.

DEPOSITING METALS FROM THE ORE DIRECT.

A method of depositing metals direct from the ore has been tried for some time in Germany, and has proved so successful that a number of metallurgical works are to be equipped for this process of treating the ore. The copper ores (as the process has been used most for refining this metal) are first ground to a fine powder and then leached in a hot solution of copper chloride, the effect of which is to dissolve the copper, silver, lead, and nickel, and change the solution to cuprous chloride. By the action of lime the arsenic, bismuth, antimony and iron are eliminated and the solution, after being filtered, is passed into a receptacle divided by a diaphragm. Here an electrolytic action occurs. The anode being carbon and the cathode copper, the copper of the solution is deposited in the cathode chamber, while the chlorine set free in the anode chamber combines with the solution to form cupric chloride, which serves to dissolve more of the copper ore. There is no loss of the solution, as the action is continuous. It is claimed for the process that the yield is far in excess of the usual methods, and that silver, lead and nickel are also obtained in a free state.—Ex.

TELEPHONY.

SOUND TRANSMISSION MAGNIFIED.

Mr. Dussaud has studied the best means of intensifying the sound transmitted by a microphone to telephone receiver. He produced a steady sound by means of an electrically driven tuning fork placed in front of an extremely sensitive microphone. At the receiver end the circuit divided into four branches, each actuating a separate telephone membrane. Mr. Dussaud tried various combinations of the four receivers, and found that the more numerous they were the louder was the sound. It was also found advantageous to collect the vibrations from both sides of the membranes. He employed a set of collecting tubes, says the "Electrician," all leading into a resonator of the shape and size of a human mouth. He was thus enabled to reproduce the sound of wind instruments and the human voice in a large hall accommodating 1,000 persons, and with such loudness that they could be heard in every part of the hall. On the State telephone system of Geneva, communication was established between two subscribers in such a manner that ordinary speech could be heard in every part of the room. As only two Laclanche batteries were used, the increased efficiency was due solely to the new arrangement for transmission.

ELECTRIC RAILWAYS.

AN OPPORTUNITY FOR BROOKLYN MOTORMEN.

The United States General Consul at Shanghai, China, Mr. Goodnow, in a report to the Government regarding tenders for an electric railway system, states as follows:

"The streets of Shanghai are, generally speaking, both narrow and crooked. The Chinese have a habit of walking in the middle of the street, in sublime indifference to everything and everybody. They are as curious as children, and will want to discover what there is in the wire to make the car go. How much difficulty will be occasioned by these peculiarities will be learned only after experiment."

This statement will, no doubt, awaken a desire in the far-famed motormen of Brooklyn, to emigrate to those regions, where the peculiarities of the trolley are as yet unknown. There seems to be untold woe in store for the guileless "middle of the road" Mongolians.

ELECTRIC MOTORS FOR HOUSEHOLD USE.

Small electric motors are now being made in Stuttgart, Germany, for many household purposes, with the view of lightening work and trouble. They are light and portable, and can be connected by an ordinary flexible cord to an ordinary lamp socket. Several illustrations of the motor and its mode of application are given in the "Western Electrician." The motor can be used for driving a chopper, a knife and fork polisher, a spice mill, and for many other purposes, such as a kneading machine in bakeries, bottle washing apparatus in hotels, etc. This motor is provided with a worm gear whose shaft makes from 40 to 50 revolutions per minute—a speed necessary for driving the average machine for which it is built. At the end of the shaft is a grooved cone pulley by which it can be connected to the machine to be driven. A small amount of current is used by these motors—from 100 to 250 watts an hour—according to the size. It is to be remembered that, as a rule, they are in actual use only for a short time, so that the prediction is justified that before long the small electric motor for household purposes will come largely into use. The instantaneous stopping of the motor is accomplished through a brake contrivance directly connected with the resistance. Inasmuch as the motor, at a moderate speed, requires but about 100 watts, the cost of running would not much exceed 2½d. a day of ten hours' running. Another machine of the kind is a wash mangle, or laundry ironing machine, and to permit of the working of the goods backward and forward between the rolls, there is a reversing switch provided that the operator can use while guiding the articles through the machine.

BUSINESS NEWS.

THE WARREN-MEDBERY CO.

THE ELECTION OF OFFICERS—PRESENT AND FUTURE PROSPECTS.

The annual meeting of the stockholders of the Warren-Medbery Co. was held at the office of the company, in

Sandy Hill, at 10 A. M., Monday, Jan. 16. The meeting was for the purpose of electing directors for the coming year. Following is the board of directors: H. E. Tidmarsh, George W. Wait, W. W. Wells, W. H. Cunningham, C. W. Kellogg, H. B. Warren and S. C. Medbery. The first meeting of the new board of directors was held after the stockholders' meeting, and the following were elected officers of the company: President, H. E. Tidmarsh; Vice-President, H. B. Warren; Secretary and Treasurer, George W. Wait.

The officers' report, concerning the past year's business, indicates a very gratifying amount of business done under satisfactory conditions, and with a very encouraging outlook for a greatly increased amount in sight for the coming year. In the first year of its existence, the company has become very well and very favorably known in the electrical trade. Its apparatus is giving perfect satisfaction. Its sales agencies throughout the entire country are well organized, and the inquiries for Warren-Medbery generators are constantly on the increase. The officers and shareholders of the company considered the prospects of the company so encouraging, that they have determined to increase their capital stock, for the purpose of obtaining increased shop facilities for the manufacture of their apparatus. It is proposed to establish independent work and develop a more extended line of machinery. While the site of the new factory has not been fully determined upon, it is assured that the company will remain at this place and develop a local industry, which will ultimately prove one of the most important of Sandy Hill's manufacturing institutions.—Ex.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING JAN. 17, 1899, $81,587.

New York, N. Y., Jan. 17, 1899. The following exports of electrical material are from the port of New York for the week ending this date:

Antwerp.—Twenty-two packages electrical material, $1,990.

Argentine Republic.—Fifteen cases electrical machinery, $174.

Amsterdam.—Ten packages electrical material, $550.

Bremen.—Thirteen cases of electrical material, $8,395.

Berlin.—Twenty-seven cases electrical material, $630.

Belfast.—Fifteen packages electrical material, $324.

British West Indies.—Eleven packages electrical material, $855.

Brazil.—Seven packages electrical material, $300.

British Possessions in Africa.—Five cases electrical material, $750.

British Australia.—Fifteen packages electrical material, $1,066.

Canary Islands.—Eleven packages electrical material, $575.

Central Australia.—One hundred and forty-five packages electrical material, $2,269.

Cuba.—Seventy-six packages electrical material, $1,265.

Chili.—Three packages electrical material, $25.

Ecuador.—One case electrical material, $24.

Glasgow.—One hundred and forty-nine packages electrical material, $10,220.

Genoa.—Five cases electrical material, $176.

Hamburg.—One hundred and nine cases electrical machinery, $4,605.

Hull.—Nine cases electrical material, $327.

Havre.—Forty-three cases electrical material, $3,014; six cases electros, $245; eight cases electrical machinery, $1,317.

London.—One hundred and sixty-one packages electrical material, $25,728.

Liverpool.—Eighty-six cases electrical material, $3,564; two cases electrical material, $700.

Mexico.—Two hundred and fifty-one packages electrical material, $2,132; twelve packages electrical machinery, $1,356.

Milan.—Thirty-six packages electrical material, $1,436.

Manchester.—Two hundred and fifty cases electrical material, $2,500; eight cases electrical machinery, $730.

Moscow.—Eight packages electrical motors, $730.

Naples.—Three cases electrical machinery, $425.

Peru.—Twenty-four cases electrical material, $937.

Preston.—Six packages electrical material, $500.

Santo Domingo.—Three cases electrical material, $59.

Southampton.—Two cases electrical machinery, $24.

United States of Columbia.—Eight packages electrical material, $159.

Vienna.—Two packages electrical machinery, $65; two cases electrical material, $235.

Vallorbes.—Three cases electrical material, $125.

Venezuela.—Forty-one cases electrical material, $83.

Zurich.—Five packages electrical machinery, $1,002.

NEW INCORPORATIONS.

Henderson, Tenn.—The Henderson Electric Light Co., has been incorporated by T. B. Hardmann, N. J. Ozier. A. R. Ozier and J. C. Winninghan for the erection of an electric light plant. Capital stock, $1,500.

St. Louis, Mo.—The Van Nort Bros. Electric Co., incorporated by Sterling P. Van Nort and others. Capital stock, $5,000.

New York, N. Y.—Empire Electrical Investment Co., has been incorporated by C. D. Cook, T. E. Taylor and G. N. McWilliams, to manufacture electrical machines. Capital stock, $20,000.

New York, N. Y.—The Columbine & Hamlin Co., incorporated by J. A. Columbine, W. C. Hamlin and O. F. Bancroft; electrotyping. Capital stock, $5,000.

New Bremen, O.—The New Bremen Electric Light Co. has been incorporated by D. W. Jay, T. J. Neeley, C. Boesel, J. F. Laufersneith and A. C. Burt; to manufacture heat, light, and power. Capital stock, $15,000.

Jersey City, N. J.—The Council Bluffs Gas and Electric Co., has been incorporated by F. Gilmore, H. J. Smith, H. Wykes, V. Cumberson and others. Capital stock, $250,000.

Jersey City, N. J.—Multiplex Incandescent Lamp Co., has been incorporated by Ferdinand Von Kusserow, Grant Green and Frederick C. Russell; to manufacture electric lamps, etc. Capital stock, $25,000.

POSSIBLE INSTALLATIONS.

Sedalia, Mo.—The Sedalia Water and Light Co. has obtained franchise for the erection of a $50,000 incandescent electric light plant.

Lake Providence, La.—The Mayor may be addressed concerning electric light plant.

Thibodeaux, La.—City Clerk may give information concerning electric light plant.

Charlotte, N. C.—The Piedmont Clothing Co. will establish an electric light plant.

Chockoyotte, N. C.—Paul Garrett contemplates establishing an electric light plant.

Cullman, Ala.—The Mayor may be addressed concerning construction of electric light plant.

Tuskagee, Ala.—The Mayor may be addressed concerning the erection of electric light plant.

TELEPHONE CALLS.

Rochester, N. Y.—Home Telephone Co., has been incorporated by Frederick Book, T. W. Finnucan, C. W. Archer, A. Vogt, H. W. Davis; telephone system. Capital stock, $150,000

Fayette, Mo.—The Fayette Telephone Co., incorporated by C. E. Betts, H. K. Givens, C. E. Givens and others. Capital stock, $10,000.

Ohio, Ill.—Ohio Telephone Co. has been incorporated

by R. F. Spencer, M. E. Cadwallader and J .F. Burnham; to operate telephone exchange. Capital stock, $800.

Newport News, Va.—The Southern States' Telephone Co. is arranging to extend its lines from Newport News to Williamsburg.

Dillon, S. C.—The Peoples' Telephone Co. has been incorporated, with E. L. Moore, president and manager, and John Wilcox, secretary.

Savannah, Ga.—A telephone system will probably be established.

Abbeville, La.—C. W. Berdine and others are organiz- a company for the establishment of a telephone exchange.

Cleveland, O.—The North Electric Co. has been incorporated by C. H. North, G. C. Steele, D. B. Wick, R. A. Wilbur and M. B. Jonhson; to manufacture telephone and telegraph equipment. Capital stock, $500.

BUSINESS CHANGES.

Cincinnati, O.—The Cincinnati Edison Electric Light Co., has increased its capital from $1,285,000 to $2,000-000.

Chicago, Ill.—Owen Electric Belt Appliance Co. gave chattel mortgage for $4,500.

JOTTINGS.

HIMMER & CO., 162 William street, City, are in the hands of a receiver and there is an excellent opportunity for those manufacturing and dealing in dry batteries to get some good bargains in apparatus, etc. The whole stock will be closed out by Feb. 1.

CHARLES BESELER CO., formerly Chas. Beseler's Sons, opened up sales rooms at 251 Centre street, Jan. 1. They are manufacturing a full line of stereopticons, hand feed arc lamps, etc., and are meeting with well merited success.

AMERICAN ELECTRIC NOVELTY CO. have removed to 255 Centre street, corner of Broome, where they have larger and better equipped quarters for the manufacture of their various lines of novelties. They make the popular electric torch which several firms are striving to imitate.

STEIN & LANGLOS, manufacturing electricians, have moved to 255 Center street, where they have better light and larger facilities for making up stock orders for the trade.

WILBUR B. DRIVER & CO., 126 Liberty street, manufacturers of the "Climax" resistance wire for rheostats, state that all the prominent enclosed and open arc lamp manufacturers are using this wire, as it is better and cheaper than the imported.

EASTERN ELECTRICAL SUPPLY CO., are looking smarter every day in their new supply store at 46 Dey street. They carry a complete stock of electric light supplies.

ALBERT JAHL is doing a big business for Barnett & Co., 115 Maiden Lane. They have made a specialty of railway supplies for many years and have latterly added electric lights and general goods to their stock.

J. H. FULLER, manufacturing electrician, has opened up larger quarters at 93-95 Maiden Lane and is fully prepared to do all kinds of electrical work.

The Electrical Age.

VOL. XXIII—NO. 5 NEW YORK, FEBRUARY 4, 1899 WHOLE NO. 612

THE STORAGE BATTERY.

Station Equipment for Large Street Railway and Power Plant.

LATEST PROGRESS IN THE APPLICATION OF STORAGE BATTERIES. *

In dealing with this subject to-night, I shall endeavor to put before you some data and results from actual practice, showing the present standing of the storage battery in connection with modern engineering practice.

It has been my lot to be very closely connected with every storage battery installation of any size that is now in operation in this country, and I will describe the conditions and methods of operation of some of the most interesting of these.

The history of the stôrage battery in this country is curious, and probably comprises more troubles and trials than any other branch of the electrical industry.

I think it will be generally acknowledged that a storage battery "per se" should be one of the most useful adjuncts in every branch of electrical engineering, but the failures that were recorded in the earlier days, proved that the storage battery was not then the commercial success those interested would have us believe.

Until 1894, the use of storage batteries in this country proved most disastrous to all concerned. The reasons were many, but may be summed up briefly as follows:

1. The batteries were poorly designed.
2. No attention was paid to the mechanical features, the chief idea being to get the greatest capacity for the lightest weight.
3. The batteries were much over-rated; their full capacity being given as their normal working capacity.

In addition to this, the storage battery business, generally, was in an unsatisfactory and weakly condition. Litigation was the principal cause. The fear of protracted and costly law suits prevented capital being invested in the business, and frightened prospective users from purchasing storage batteries.

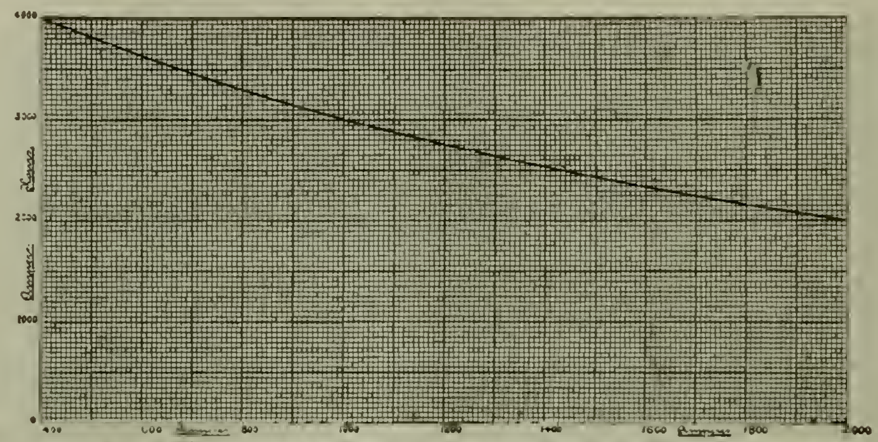
Now, the conditions are very different. You are all familiar

*Paper read before the New York Electrical Society, January 12, 1899, by Joseph Appleton.

with the changes which have been made during the last five years in the commercial end of the business. All the disturbing elements have been removed, and the business has been put on a proper and substantial basis. These results are best seen from the following diagram: The figures for 1898 have not been tabulated, but they will show that the use of storage batteries is progressing more rapidly than ever:

	Weight of plates alone.
1894	349,000 pounds
1895	1,112,800 pounds
1896	2,315,300 pounds
1897	3,607,300 pounds

Or ten times the business of 1894.

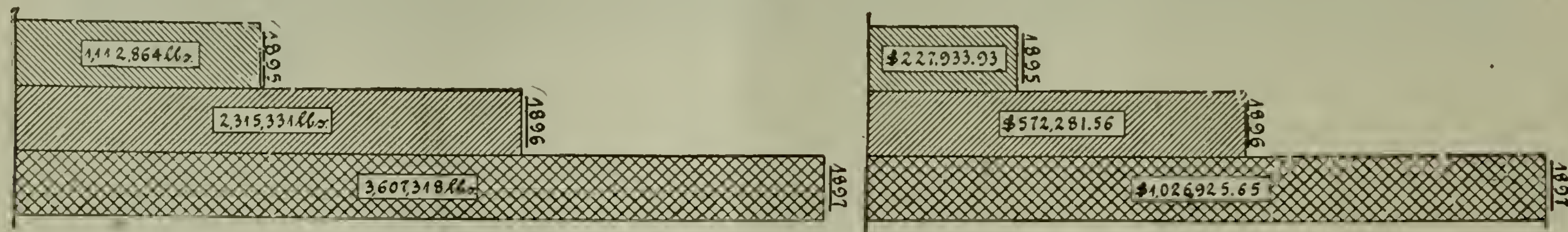


Capacity Curve for a "29 H" Cell.

The storage battery is entirely different from any other piece of apparatus, which is used for supplying electrical energy, being constructed and operated on the principal of chemical action, instead of mechanical motion. There must, naturally, be a vast difference between these two principles.

In the mechanically operated apparatus, or generator, the output of electrical energy is the result of the conversion of the mechanical energy applied to it while in action, and the regularity of the output is dependent on the steadiness of the mechanical energy applied, and the satisfactory running of the generator and motiev power. The operation is purely mechanical, and is supject to the interruptions to which all moving machinery is liable. Again, such apparatus, if overloaded to an excessive degree, will give visible signs of distress, and if the overloading is very great, or is continued, will probably give way in some mechanical feature.

In a storage battery hundreds of horse power can be silently stored, and thousands of horse power delivered for a short period, with no apparent action or change in the battery. The action is purely chemical, and as long as the respective elements are there to be acted upon, it will surely continue.



Storage Battery Output and Sales during the years 1895, '96, and '97.

It is this fact that makes the storage battery so reliable. Such a thing as instantaneous failure or interruption of the delivery of energy is impossible, except, of course, in the case of mechanical injury to the battery from an external cause.

Any mechanically operated apparatus is liable to interruption through breakage or injury to one of its parts, but in a storage battery the chemical action will continue, and, consequently, the output of energy, until all the material on the plates has been converted.

An overload has not the same effect on a storage battery as on a mechanically operated generator. For a short period an overload, even of great extent, does not injure a storage battery. It causes the chemical action to take place more rapidly, or, to be more exact, causes more material to be subjected to the chemical action, and this, if not continued too long, or repeated too often, does not affect a good storage battery. Moreover, if the overload is continued too long, it does not mean the sudden failure and collapse of the battery and complete interruption of the output, but is shown by the premature depreciation of the plates in the battery. It may not be noticed for months, or even years. One of the most valuable features of a storage battery is, that it will safely take care of any sudden and momentary overload in the system, such as grounds or short circuits, and if operating in parallel with generators or rotary converters, will relieve them of such overloads and consequent strain. I have frequently seen batteries burn out grounds on an underground system, discharging for a short time at an enormous rate. And in the case of batteries operating on railway loads, it is a common thing to see an occasional momentary discharge at a rate equal to twice the hour rate of the battery. The modern storage battery is designed to stand such occasional extreme discharges, and do so without injury.

It may be well to consider before going further into our subject the question of the rates of charge and discharge of storage batteries, and their capacity at different rates. Of course, this will vary somewhat with different types of battery, but not to a great extent. The more rapidly you discharge a battery, the smaller is its available capacity. For example, the following curve illustrates the available capacity of a storage battery when discharging at any rate between the ten-hour and one-hour rate. That is to say, when the battery is competely discharged in ten hours and in one hour. It is only within the last few years that a one-hour discharge rate has been possible with a storage battery, and it is very largely due to the fact that storage batteries can be discharged at such rapid rates that their use has been growing so rapidly.

In large engineering problems, the storage battery is used chiefly to supply large amounts of electrical energy for short periods, and by increasing the allowable rate of discharge the size of the battery required is consequently reduced. In connection with this question of the reduced capacity of storage batteries at rapid rates of discharge, there is frequently a mistaken idea that if the capacity of a battery is thus reduced, the efficiency is correspondingly impaired. This is not so at all. It is only the available capacity of the battery which is reduced by polarization, or, in other words, the chemical action when taking place at such rapid rates can only reach the active material, which is on the surface of the plates and immediately exposed to the electrolyte. Hence, in reality, the actual capacity of the battery is not reduced, only the available capacity, and when the battery is recharged, only the active material that is acted upon has to be converted, and not the entire amount of active material. There is a slightly greater loss in efficiency when discharging

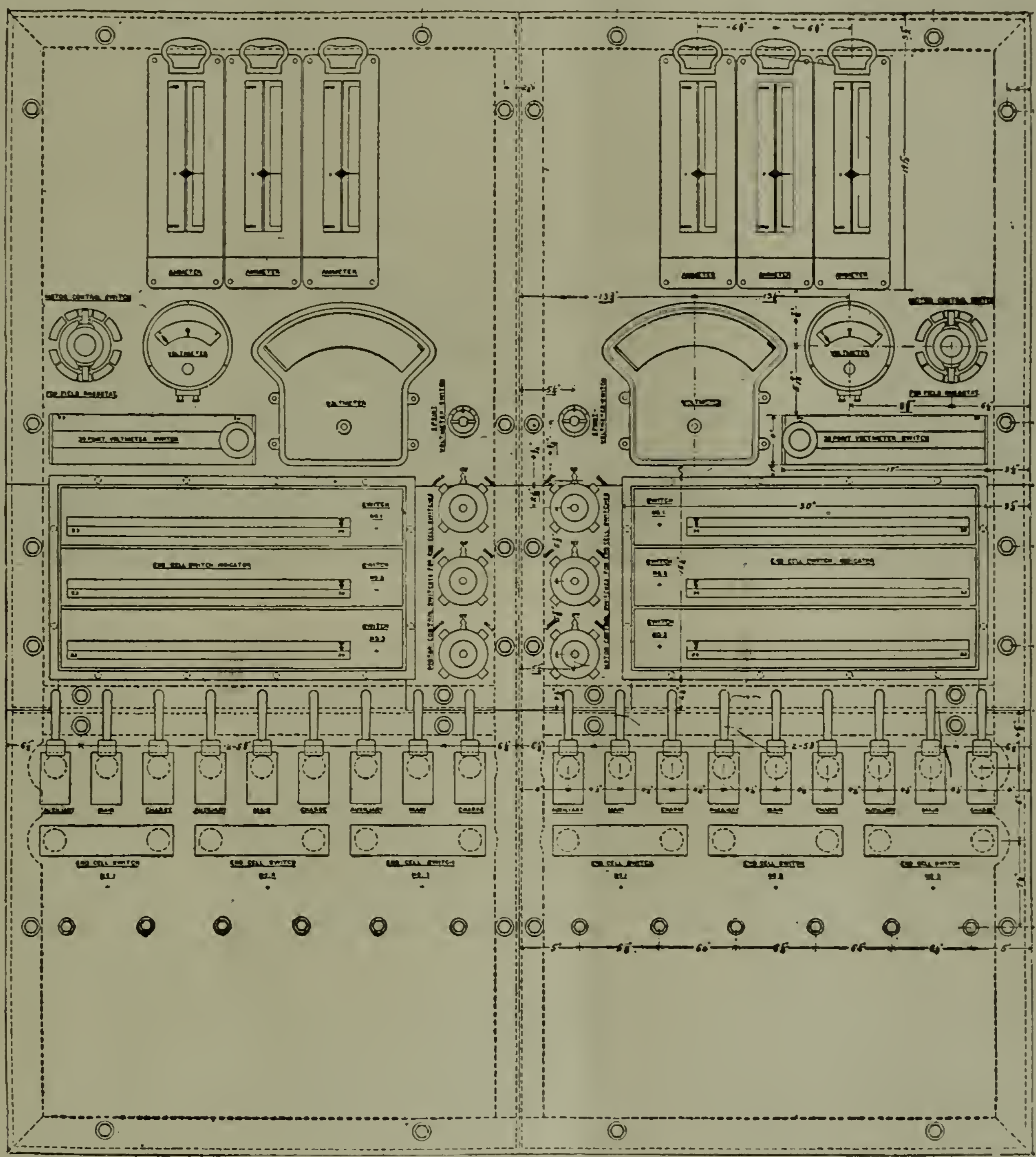
at a rapid rate, due to the internal resistance of the battery, this being the C^2R loss.

Storage batteries are not free from trouble, any more than any other apparatus, but, under favorable conditions, the comparison is much in favor of the storage battery. No piece of apparatus yet made is perfect, and its usefulness and consequent general adoption, may be said to be proportional to the predominance of its useful features, to its weaknesses or troubles. The rapid growth in the use of the storage battery during the last few years, is the best proof possible that its troubles are very small, compared to its advantages.

As is the case with all machinery and apparatus, which have to be operated continually for any length of time, the results obtained depend not entirely on the design and construction, but on the care and judgment with which it is operated. This fact is particularly noticeable to any one who is constantly brought into contact with different plants and installations, as I am, and under different management, or sometimes mismanagement, in all parts of the country, and this subject alone would afford a very interesting and profitable topic for discussion and consideration.

In the early days, the storage battery manufacturers, in order to maintain a bare existence, had to jump at every opening for the use of a storage battery, whether the conditions warranted it or not, and in order to do business, accepted contracts drawn entirely from the purchaser's point of view, without regard to the capabilities of the storage battery, and guaranteed results, which, to say the very least, were extremely difficult to realize. What the results of all this was, you know very well.

Now things are entirely different. The business is on a commercial basis, and it is not a question of getting an order at any price, but securing business which will prove satisfactory and permanent. Now, storage battery manufacturers will insist on proper conditions for the operation of their batteries, or refuse to put them in. This is as it should be, and I think I am perfectly safe in saying that during the last four or five years there has not been a storage battery installed in this country, except under conditions which justified its use (of course, some experimental applications have been made, which may or may not prove satisfactory, but this does not come under the head of the general application of the storage battery).



Storage Battery Switchboard Panel, Chicago Edison Company.

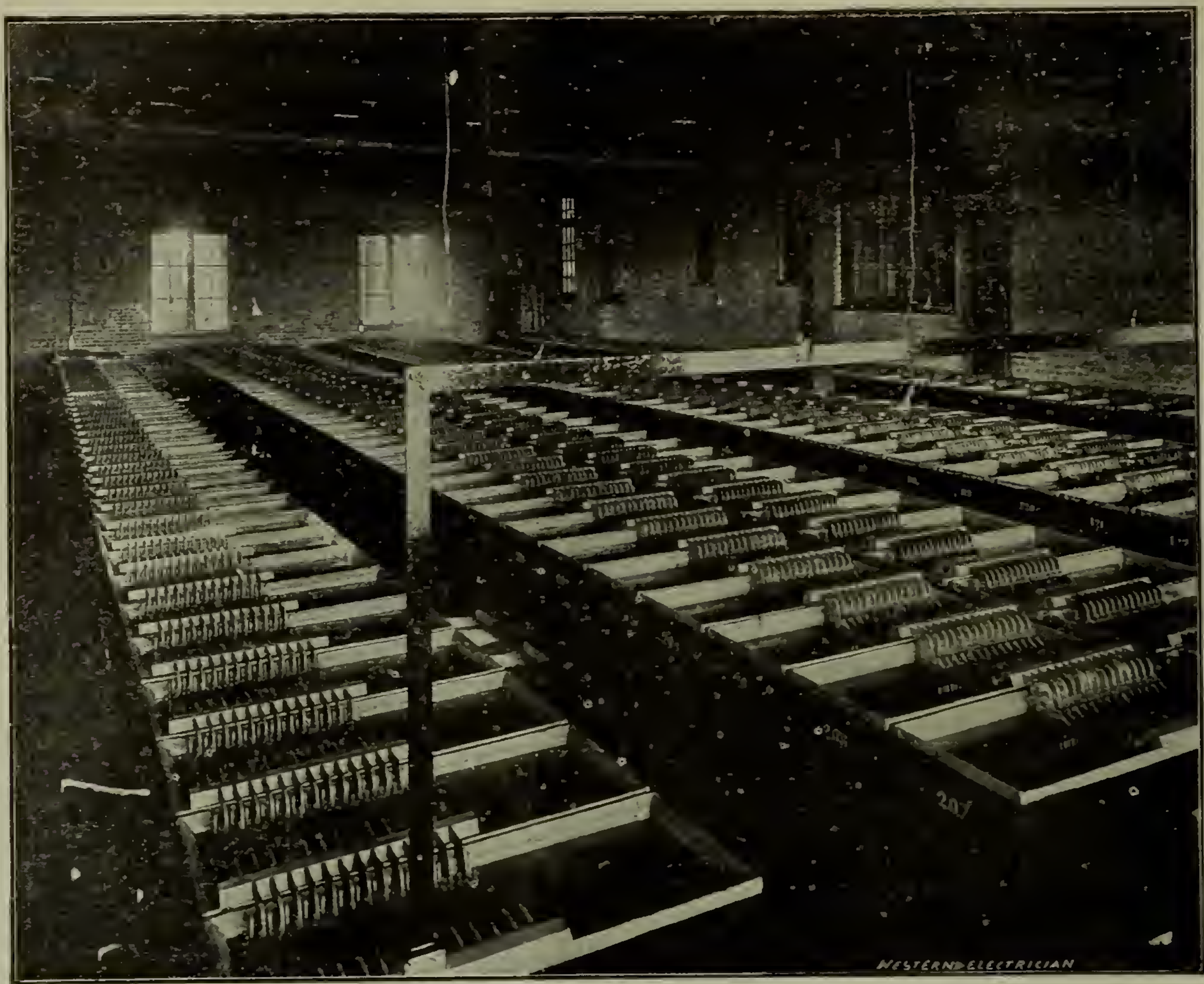
It should be distinctly understood that all conditions of electrical distribution are not suitable for the use of storage batteries, and that it is more to the interest of the manufacturer than the purchaser to confine himself only to those situations which are suitable—for every failure which is recorded is heard of one hundred times to every success.

Now that, by this method of doing business, confidence in storage batteries is being regained, and proper relations have been established between manufacturers and users, the growth of the use of storage batteries will be still more rapid, for it is now realized that when storage batteries are installed and oper-

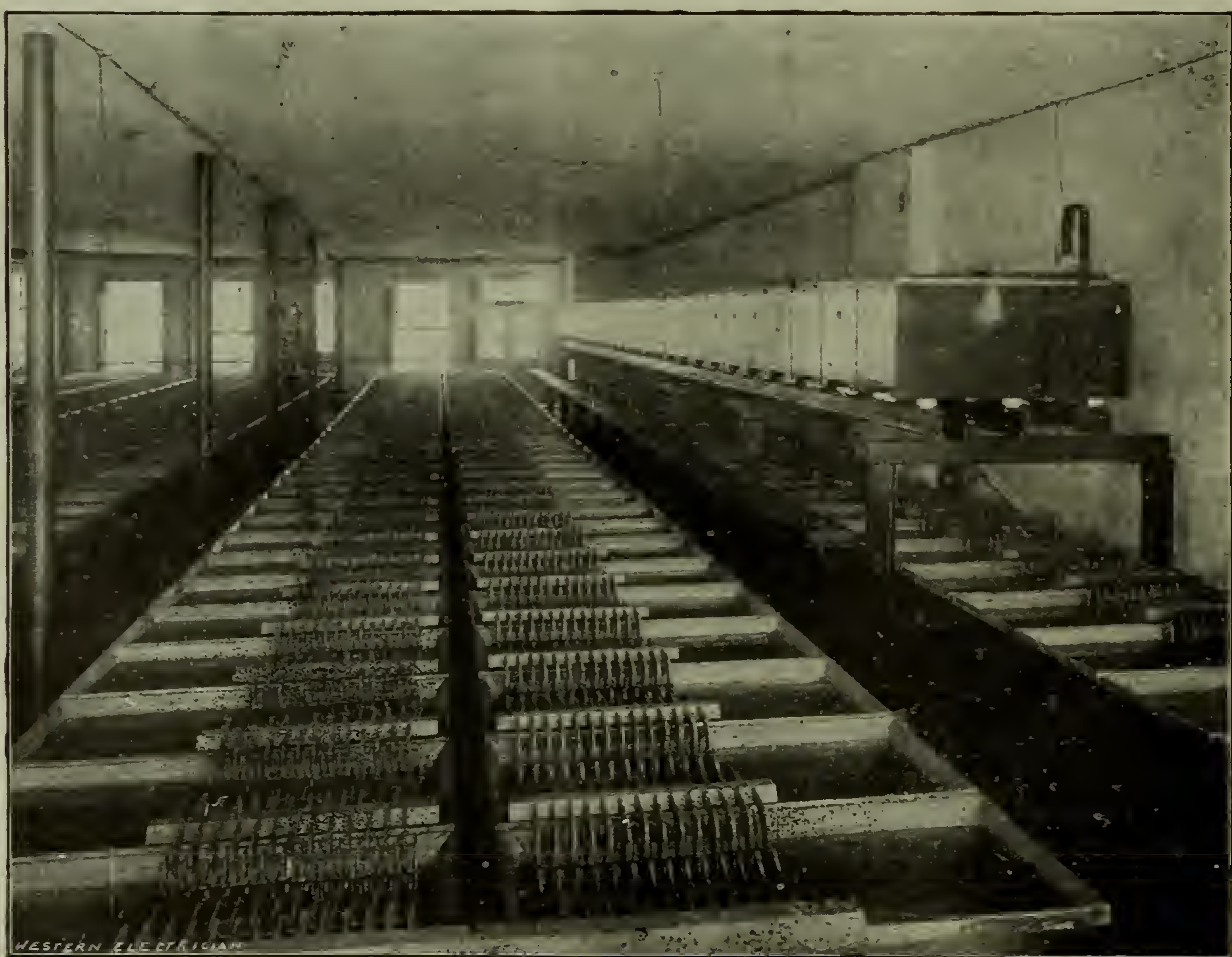
ated under proper conditions that the result will invariably be satisfactory.

The trend of electrical engineering is, to-day, toward the concentration of generating machinery, the highest possible economy in operation, and the utilization of motive power and generating machinery to the fullest extent, so that the investment may produce the greatest return. These conditions make the storage battery indispensable, for without its aid, it is impossible to maintain a constant load on the power house.

Every application of electricity has its time of maximum output or "peak," and no matter how many different applications are supplied from the same system, their peaks will not fit in so



View Within an Auxiliary Storage Battery Station Along the Line of Traffic.



Large Battery Plant in Substation.

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CONTENTS:

CHOKE COILS.

The function of a soil is not limited entirely to one purpose. The flow of current decides so largely what this function shall be that the mere magnetic effect so familiar is but one of the consequences of a current taking such a path. As a rule, a coil is used for producing a magnetic field, which, in a motor, dynamo, telegraph or telephonic instrument, is absolutely essential to the success of the mechanism in which it appears as the chief factor of usefulness.

But a coil carrying a current that oscillates or alternates, becomes, as it were, an entirely new device, possessing unique qualities and serving a purpose as unexpected and interesting as could have been anticipated. On account of this new property the name "choke oil" has been given to it, a term whose forcible vulgarity to bound to awaken questioning remarks. An alternating current passing through a coil of a given number of turns, etc., is choked to a greater or less degree, depending upon certain electrical elements upon which its construction is based.

The first of these is self induction, whose resistance to the passage of an oscillatory current is without question exceedingly great. A lightning discharge may pass back and forth in a circuit at a rate of from twenty to forty million reversals per second. On the other hand, this coil is a perfect conductor for a direct current. The choking effect of the coil is entirely dependent upon its form, which, in any given case, determines the exact amount of impedence it is capable of creating.

In conjunction with a lightning arrester, a choke coil possesses numerous advantages. Electric light and power plants rely upon the effective guard these devices enable them to receive in the line of protection from sudden lightning discharges. In cases where the initial line pressure is high lightning arresters, with the regular choke coil attachment, are an absolute necessity. The pressure of some transmission lines runs up higher than thirty thousand volts.

The ordinary risks of leakage, short circuiting, etc., are not very easy to overcome, consequently more than ordinary means would be presumably employed to protect a higher pressure transmission plant from the dangers of a thunder storm. The services of a choke coil under such circumstances have been invaluable, the lightning arrester itself only becoming important in conjunction with it.

The range of current a choke coil can carry will run from seven to two hundred and sixty amperes. The lightning arrester is generally designed upon such bases as the following: "A discharge will pass over a non-conducting surface, such as glass or wood, more readily than through an equal air gap."

"The discharge will take place more readily if a pencil or carbon mark be drawn over the non-conducting surface."

"In order to maintain a dynamo, arc fumes, or vapors, of the electrodes must be present; consequently, if means are provided to prevent the formation of these vapors there will be no arc."

"Charred or carbonized grooves provide a ready path for a discharge. Disruptive discharges pass readily between electrodes over charred grooves, which act simply as an electrical crack through the air, providing an easy path."

In modern types of arresters the resistance between electrodes is more than fifty thousand ohms, and the number of turns to each coil practically equals one dozen. We have mentioned in previous editorials the necessity for making a good ground connection from the arrester to the earth. Electric light or power stations, which are at all affected by a lightning storm, are put to the expense that follows entirely on account of inefficient or insufficient arresters.

To facilitate the discharge in its passage to earth, connections between the arrester and water tanks are frequently made. The expense to a corporation caused by the shutting down of the plant when struck by lightning may become very serious at the end of a few years. Excuses and explanations which afterward occur, do not, in any way, pay for the injuries sustained, nor make good the losses. The truth of the saying, "that an ounce of prevention is worth a pound of cure," cannot appeal with greater force to ourselves in daily life than to the supervising engineer or superintendent of an extensive and important electric system.

With a properly designed choke coil, a fairly good lightning arrester, acting co-operatively, and a good ground connection, the risks that may possibly arise are reduced to a minimum. These risks have so great an effect upon the dividends of a company in the long run that no executive in charge of business affairs can afford to deny himself a large family of lightning arresters. If electric light and power plants operate for the good of the individual, as well as the community, it necessarily follows that a stockholder, in considering himself, is really protecting the interests of his fellow men.

The General Electrical Co. will supply eight electric locomotives and other equipment for the tunnel of the Paris-Orleans Railway in Paris. The company some months ago secured a contract to supply twenty-eight electric locomotives to the new Central London Underground Railway Co.

On June 30, 1898, the number of locomotives owned by the Northeastern Railway was 1,963, of which 573 were passenger engines, 1,166 goods, and 224 engines for shunting. Of these about 72 per cent. were in use daily. The number of engines built per annum, judged by the average of ten years ended December, 1897, was 65; the new boilers built annually were 150, and the engines repaired annually, 920.

as to even matters up, but, on the contrary, it is found that in many cases the peaks occur at about the same time. This is particularly noticeable with a railroad and lighting road. Again concentration of generating machinery means a larger area for distribution, and the necessity of sub-stations, in order to keep down the investment in conductors, and experience shows that in the majority of cases storage batteries are cheaper than the copper alone, which would otherwise be necessary, leaving out the advantages at the power house. This means that the storage battery will now play a most important part in all electrical problems, and be of sufficient importance and value to warrant the conditions being made suitable for its use instead of, as in early days, being dumped in at any time to fill up a gap and smooth over any difficulties which cropped up.

It used to be customary to refer to European practice, to show what could be done with storage batteries, and even now I believe that some people think that European batteries and methods are superior to ours in this country. In connection with this idea there is one thing that I particularly wish to emphasize, and that is, the difference between American and European conditions.

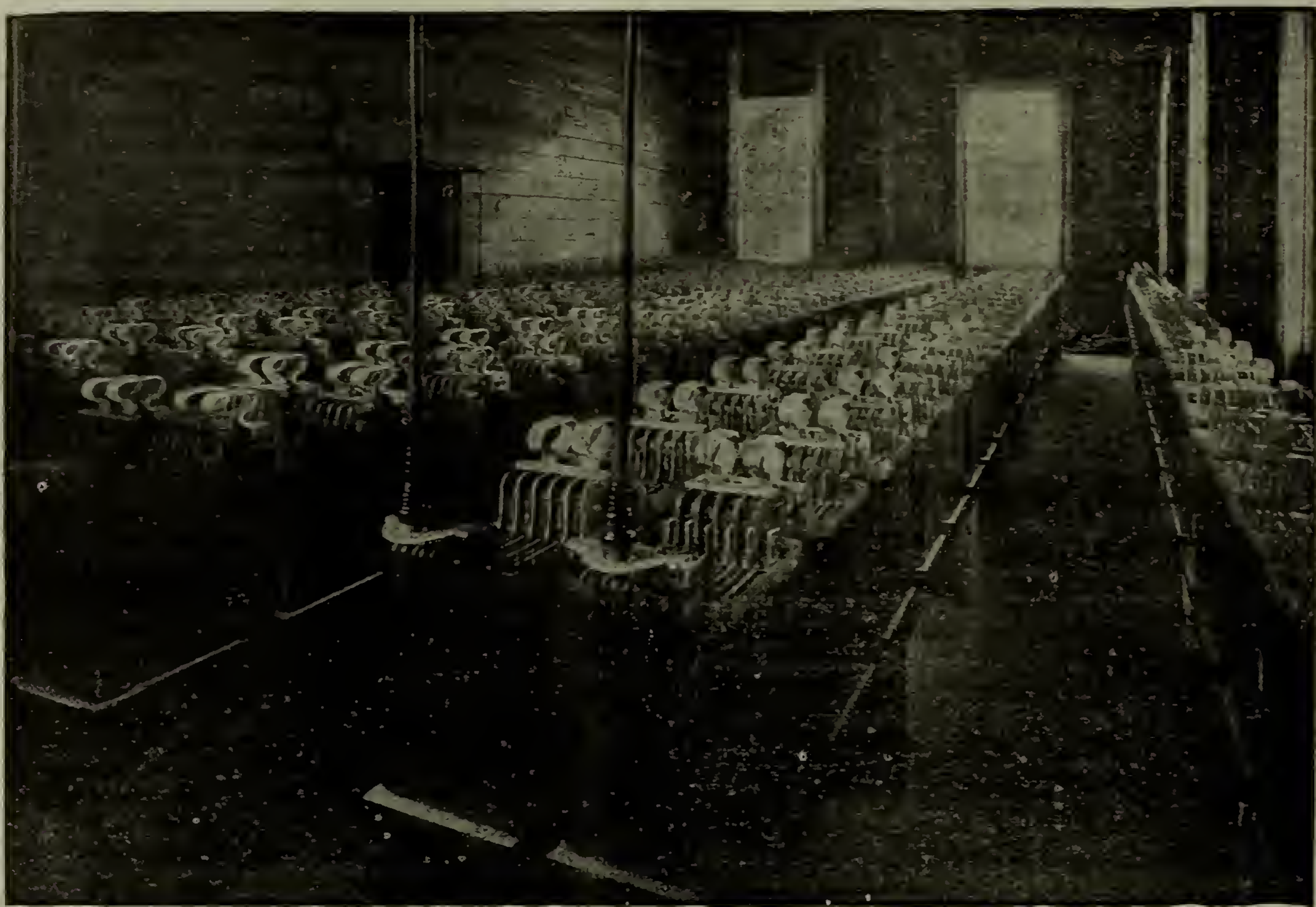
In Europe storage batteries are not subjected to the severe work they have to stand here. They are looked upon more as a reserve, and are not expected to discharge at their maximum rate every day, and perhaps twice on some days.

As an example of this, I will tell you what one of the Tudor Company experts from Germany said, when he was over here last spring. He was attending the National Electric Light Convention at Chicago, and one of the features of that convention was the large storage battery plant, which the Chicago Edison had recently installed. During one afternoon while the Convention was being held, a very heavy thunder storm canme on, and the battery was called upon suddenly for its maximum rate of discharge, and the full rated capacity was taken out. The maximum rating of this battery was a complete discharge in one hour. Our German friend thought that was doing pretty well, but when we told him that this storage battery was installed under contract, which allowed the battery to be discharged at this rate every day during the winter, he was horrified and said:

"You must not let them work the battery in that way; tell them they must hold it as a reserve." We told him that if we did that we should not be able to do any business, and that we simply had to meet these conditions, and could do so without any difficulty. This instance will show why batteries are maintained at a lower figure in Europe than here, and why it has been customary to refer to the behavior of the battery in Europe.

It is a fact that we have now in this country many storage installations, which surpass anything in Europe, both in size and method of operation.

The methods of applying storage batteries in connection with electrical engineering work are so numerous that it would be impossible to deal with them all this evening, so I have selected a few for consideration as showing clearly the great flexibility of the storage battery as an adjunct to any scheme contemplating the generation and transmission of electrical energy. We will first consider the storage battery installation of the Chicago Edison Company.



Storage Battery at Barre Transfer, Montpelier, Va.

CHICAGO EDISON INSTALLATION.

This installation is particularly interesting as being the largest individual battery ever installed for a lighting station.

The Chicago Edison Company had their original power plant in Adams street, which is practically in the center of the downtown section of Chicago. This plant was abandoned in August of 1894, just six years after it was started up, and a large modern power house was erected on the river front at Harrison street.

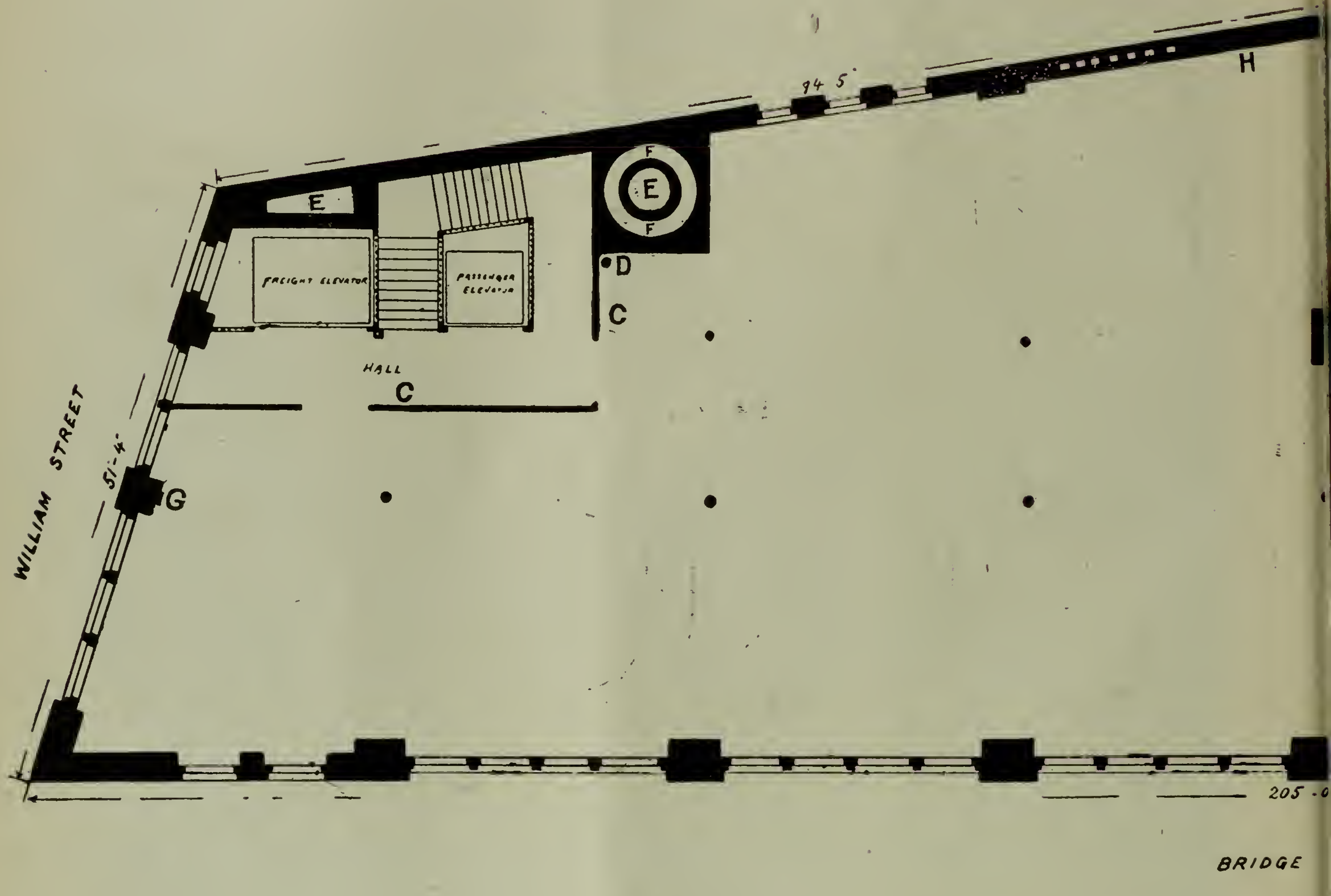
Their maximum load in 1897 was 44,000 amperes, or 8,000 electric horse power, and early in 1898 it was estimated that the maximum winter load for that year on the downtown system would be in the neighborhood of 55,000 amperes. In fact, the point had been reached when new investment, either in generating capacity or battery had to be made.

The peak of their load during the winter, as will be seen from the following curve, occurs about 4.45 P. M. and lasts from 45 minutes to one hour and a half. Their method of operating is as follows:

The current from the Harrison street station is transmitted over lines to the old Adams street building, being distributed

METROPOLITAN REALTY BUILDING,

214, 216, 218 William St. and 18-20 Rose St.



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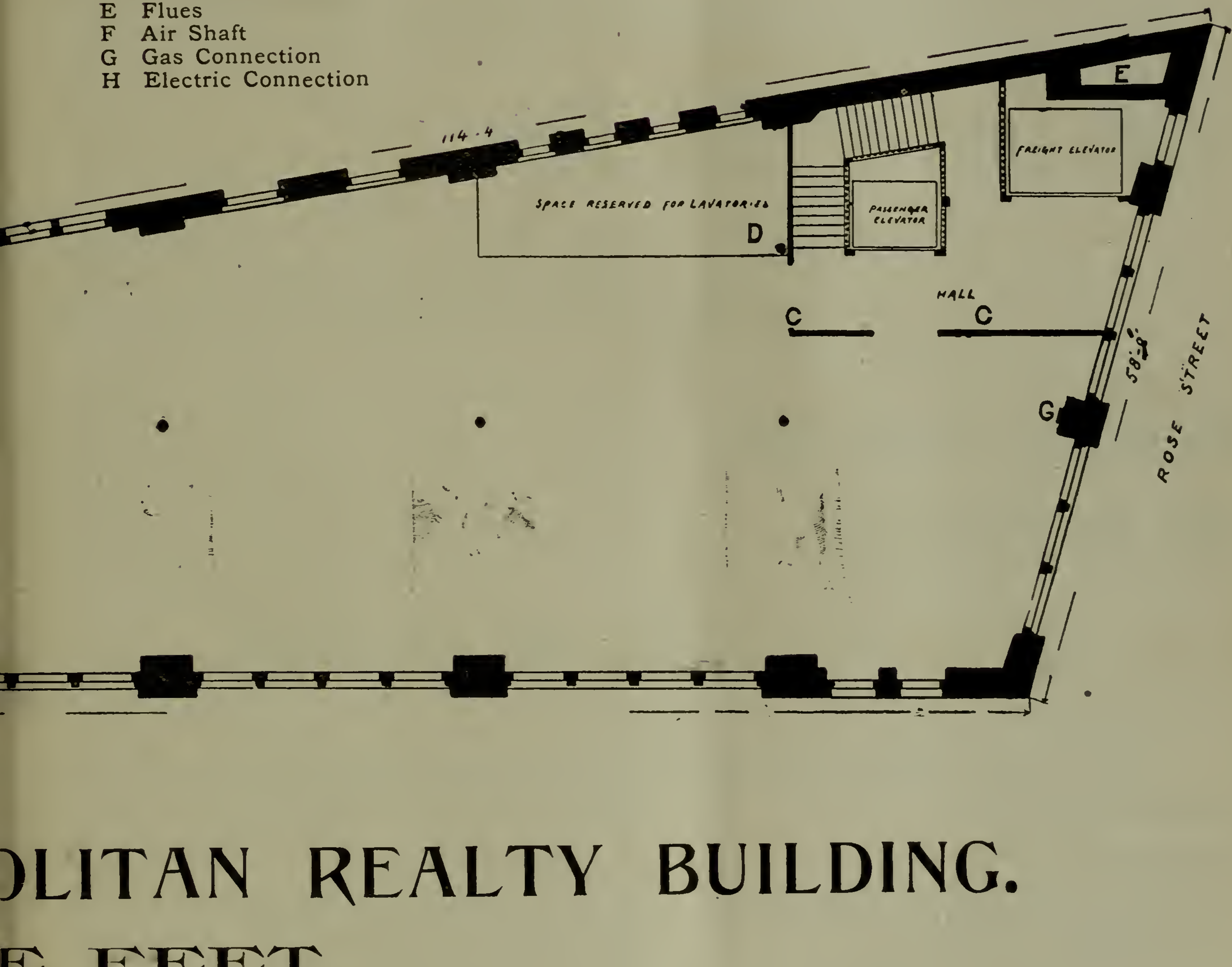
A Watchman's Clock
C Fire-Proof Partitions
D Fire Hose
E Flues
F Air Shaft
G Gas Connection
H Electric Connection



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over the network of mains from that point. The distance between Adams street and Harrison street is about 3,340 feet, and the tie lies between the two places have a capacity of 66,000,000 C. M. If additional generating capacity had been provided for the peak of 1898, it would have meant a corresponding increase in this tie line, but by installing batteries at Adams street, the center of distribution, not only was the saving in generating capacity effected, but also in the tie lines. The battery installed at Adams street consists of 166 cells, arranged 83 on each side of the three-wire systems, and each cell contains 87 plates 15½ x 32 inches. The containing cells or tanks are constructed of 2-inch ash, lined with 5-pound sheet lead. The dimensions of each cell are 9 inches wide, 6 feet 8 inches long, and 4 feet high.

The weight of each cell is 6,200 pounds complete, and the total weight of the battery is, exclusive of copper conduction, 1,092,200 pounds. The battery is installed in the basement of the Adams street building. The following slides will give a good idea of the general arrangement, also the switchboard room, from which all the current is distributed and the battery operated.

The battery has a capacity of 22,400 ampere hours at the eight hour rate; the maximum rate of discharge being 11,000 amperes for about 1¼ hours. Thirty of the 83 cells on each side of three-wire system are end cells, and are connected to three end cell switches on each side, so that, if desired, the battery can discharge at three different pressures. These switches have a capacity of about 3,000 amperes each, so that they will fully take care of the maximum disharge of the battery. The connections between end cells of the battery and these switches are made by copper conductors 6 x ½ inches, and the main connection of the battery of copper conductors, 6 x 1 inches, giving a sectional area of six square inches.

The end coil switches are located near the battery and are operated from the distributing switchboard room by small electric motors. The following slide shows one of these switches with the motor control. It is so arranged that when it is desired to cut in or out any number of cells, it is simply necessary for the switchboard attendant to press a little button, which will operate the motor and move the switch over from one contact to the next, the switch stopping automatically when it is in a proper position on any contact. Indicators are provided on the switchboard to show the attendant how many cells are in circuit on each switch.

By discharging this battery at two or three different pressures it is possible to load the feeders up to their full capacity, a thing which was impossible when the distribution was made from one pressure, as was previously the case.

Both the short and long feeders running from the distributing board at Adams street can be supplied with the necessary voltage, 120 to 140 volts, to utilize their full capacity, making a large saving in the cost of the feeders. The charging of this battery is done over the tie line from the Harrison street station, no boosters being used.

When charging, a pair of generators in the Harrison street station are disconnected from the system, and connected to a portion of the tie line for charging the battery, the necessary voltage being obtained by speeding up the generator. This method obviates the investment required for boosters and makes the efficiency of the battery higher, as the generators are always run at their full capacity. This slide shows the load curve for two days in the winter, and it will be seen that the battery carries about 11,000 amperes during the peak of the load, or about 26 per cent. of the total load. The advantages of batteries under these conditions will be readily seen, as they will take care of the maximum load during the short time it occurs, and will increase the load on the generators during the remainder of the time when they have to be charged.

The battery is used in addition to carrying the peak of the load for maintaining a constant pressure on the system, and relieves the switchboard attendants at the generating station from constantly watching and regulating the pressure, the battery taking care of any fluctuations automatically.

In a lighting and power station such as this, the maximum load occurs for only a very short period during the year. In one station I know of 50 per cent. of their investment in generating plant and underground conductors is only used for 154 hours during the year. This statement may seem astonishing, but will be found to apply to many such stations. Where these conditions exist it will readily be seen how great are the advantages of storage batteries as auxiliaries. Their cost per kilowatt of output for short periods, such as these peaks, is less than the generating machinery, which would have to be provided if they were not used, in addition to which there are other ways in which they prove advantageous in the operation of the plant.

The application of storage batteries to such stations, such as this, can be made in two ways, viz., at the main power house or in sub-stations.

Each method has its own advantages, and should be determined in each case by the conditions which exist.

When batteries are placed in sub-stations they will relieve the generating plants of the maximum load as just described, and also effect a large saving in the underground system of conductors, as, at the time of maximum load, the conductors between the main generating station and the sub-stations are relieved of that portion of the load, which is carried by the batteries and distributed from the sub-stations.

The use of large water powers as a motive power for generating stations from which electrical energy is transmitted and distributed over extended areas is growing. Take, for example, the Niagara and other plants. In connection with such installations storage batteries play a very important part.

The power from such a plant is largely sold for manufacturing purposes, and is charged for at so much per horse power per annum, the power being available 24 hours per day, while the mills and factories using this power do not usually run for more than ten hours per day. Therefore a man who requires a maximum of 100 horse power for 10 hours a day, or 1,000 horse power hours, really has to pay for 2,400 horse power hours, while he uses only 1,000, and probably less, for the average, rarely, if ever, exceeds 70 per cent. of the maximum.

With a storage battery capable of supplying 50 horse-power for 10 hours, or 500 horse-power hours, he need only pay for one-half the amount or 50 horse-power for 24 hours, as the battery will furnish the remainder, and can be charged during the 14 hours he is not using the power. In addition to this, the battery will take care of any fluctuation above the average, and enable the man to buy the average amount of power he requires, instead of the maximum.

Such an installation has been made by the Buffalo Street Railway Company. Before describing this installation I would like to mention the different methods of installing storage batteries in connection with railway plants. These may be divided into two classes:

First—Where the battery is installed at the power house to take the care of the peak of the load, and the fluctuation of the generators; and,

Second—Where the battery is installed at the end of a long feeder to keep up the pressure at that point, and to obviate the necessity of sending the maximum amount of current over the long feeders from the power house.

We will consider an installation of each kind and their respective methods of operation.

The Buffalo Street Railway Company's plant is of the first class, and is especially interesting, inasmuch as it is operated in connection with the Niagara Falls power. They operate practically all the cars within the city limits, and have a steam plant capable of delivering 7,000 electrical horse-power, in addition to which they take 2,000 horse-power from the Niagara Falls power, this current being transmitted in the form of high tension alternating current from the Niagara Falls to the power house, and being then transformed by rotary converters to the ordinary 550 volt direct current.

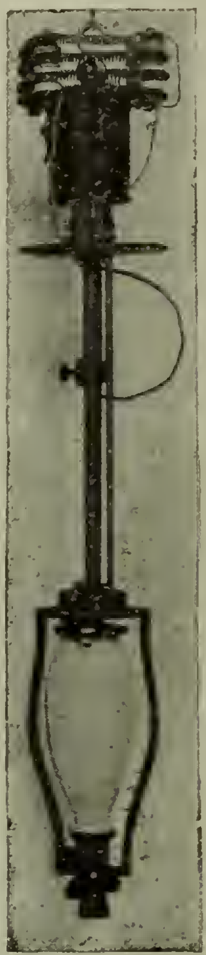
The storage battery is installed at the main power house, and is connected directly in parallel with the steam plant and rotary converters.

(To be continued.)

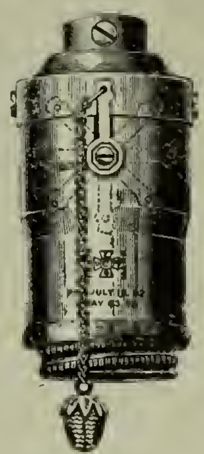
LIGHTING.

THE ENCLOSED ARC LAMP, MANUFACTURED BY THE UNIVERSAL ELECTRIC PULL SOCKET AND SWITCH COMPANY.

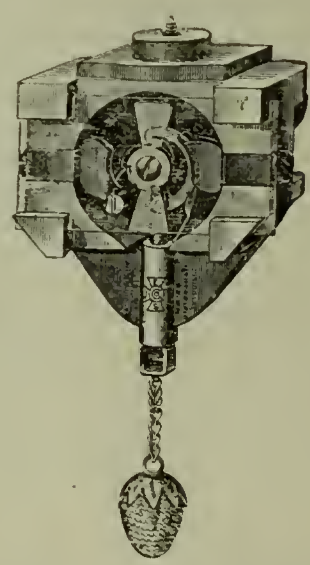
The Eschwei enclosed arc lamp, weighing but eleven pounds, is placed upon the market by the Universal Electric Pull Socket and Switch Company, 35 South William street, New York City. The lamp is twenty-seven inches long and well proportioned. The negative holder is readily removed when the lamp is being trimmed by turning a winged screw. A great feature, worthy of prominent notice, is that the inner globe, during the trimming operation, is left intact, as it is before trimming. Arc lamp men will appreciate this important point, as it represents, to those using the lamp for extensive lighting, a great saving of time and money. A clamp guided by two rods supports the upper carbon. These are insulated from the rest of the lamp by mica and the gas check, which is stationary and supported in the upper part of the negative frame by its own weight, makes a successful joint. Aside from details of the arc lamp construction, it is fitting to mention that the pull switch manufactured by the above company, in conjunction with the arc lamp, works wonders in the line of convenience and economy. Each arc lamp is independently controlled. The laying of wires and wall switches is avoided. The convenience of being able to turn on and off any lamp at pleasure, makes this device one of all-around consequence. The further construction of the lamp shows that the positive carbon is controlled by a lever ring switch, which, in its turn, can be manipulated by means of a spring. To avoid the jumping of the arc the above company fasten the clutch rod to a diaphragm of iron, thereby effectually removing an inherent fault in lamp construction. It is a common defect in lamps that at the start there is a temporary discontinuation of the arc. The effect upon the eyes and sensibilities of a layman is apt to produce criticism, not always of a charitable nature. In overcoming this trouble, which, apart from the delicate regulation, might be considered as of but little consequence in the shop, considerable merit is due Messrs. L. Stirn, C. & G. F. Eschwei and M. Duklauer, members of the above concern. A very fine adjustment, consisting of a set screw and jam nut, on the diaphragm, give a range of adjustment of the arc for different voltages of a highly commendable nature. These and other features, including the helically coiled resistance wire on the top of the lamp, provide all the elements of a technical and commercial success. In addition to the above, the '98 pull socket of universal fit for all bases of incandescent lamps is self contained, simple to operate and



The Eschwei Enclosed Arc Lamp.



The Universal Pull Socket.



The Universal Pull Switch.

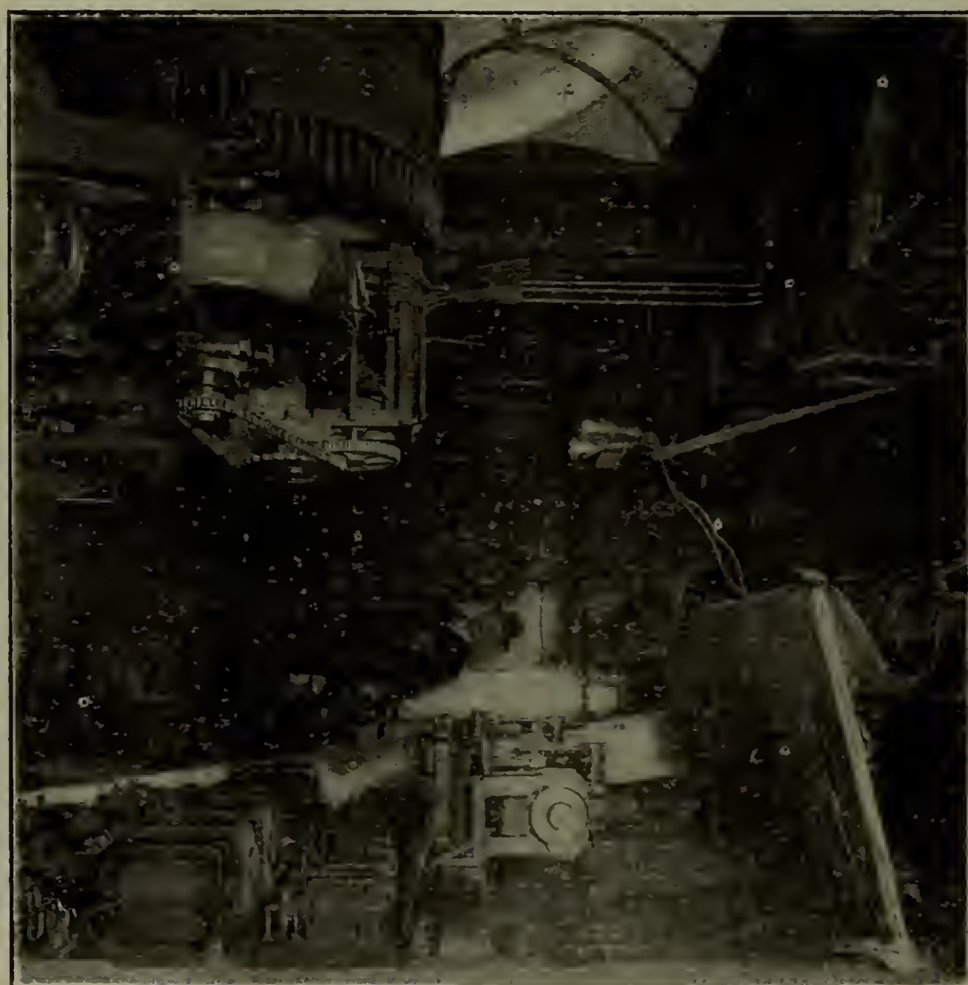
exceedingly practical to use. A pull and the lamp is on, another and it is out. The specialties are highly finished, low priced and of excellent quality. Purchasers or customers will do well to call at the address of the Universal Electric Pull Socket and Switch Company.

BUILDINGS FOR THE TRADE.

AN EXCHANGE FOR ELECTRICIANS.

Office buildings are constructed nowadays with the understanding that they shall serve for a given purpose. We find magnificent palaces for business men occupied respectively, according to the location, by lawyers, architects, banking people and engineers. In a previously published article we spoke of an office building for the electrical trade, referring to the White Building, 95-97 Liberty street, New York City. This is a twelve-story, fireproof building, and is situated on the north side of the street, between Broadway and Church. It has an imposing granite front, and is constructed of brick and steel, with an iron frame. The floors are marble, entirely fireproof, halls beautifully tiled and the whole interior of the building presents an agreeable and harmonious sight to the visitor. The building is equipped with two Sprague electric elevators, which are run day and night, for the convenience of tenants, who can have rooms on any floor, either single or en suite. All rooms have plenty of daylight, besides being equipped with electric lights, the power for which is generated by a plant in the basement of the building. This plant consists of two sparkless and smooth running 50 kw. and one 25 kw. Eddy dynamos, direct connected to Russell engines. The plant was installed by the Russell Engine Company, and the wiring done by the Conduit Wiring Company, of this city. Every detail of a fire underwriters' demands have been carefully complied with in perfect accordance with the latest and best specifications. Consequently, the electrical machinery, and, in fact, the operation of every electrical and mechanical device in the building is thoroughly trustworthy, up-to-date and highly perfected. This large and beautifully fitted office building already possesses such tenants as Fostoria Electric Company, "Locomotive" Publishing Company, James H. Lancaster, Albert A. Carey, consulting engineer; Brooks & Co., Stirling Boiler Company. Being absolutely fireproof and possessing such advantages and conveniences that those doing business in this building are in the very heart of the electrical trade, those about to rent new offices during the present year and looking for a desirable location cannot do better than visit the White Building. Mr. E. S. Willard, 26 Cortlandt street, New York City, the agent, will be pleased to escort visitors around and answer any questions which may be asked relating to rent and accommodations.

The White Building.



View Showing Elevator Hoist and Electric Protective Devices. (The White Building.)

COMPETITION.

(From London "Electrical Engineer.")

Sometimes a glance at what other folks are doing does good—sometimes raises the bile. It may, we hope, do good to see how Brother Jonathan is trespassing upon our own ground. Just glance at his exports of electrical apparatus to England and its colonies for a week. The value of such apparatus on the week ending December 6, the last for which we have the figures, reached the respectable sum of over twenty-five thousand dollars, the total exports reaching nearly sixty thousand dollars, so that England and her colonies are taking a goodly share of apparatus from America. If we were to include such places as Egypt, the position is still worse against us. There is no reciprocity in this trade. America does not absorb our goods to anything like this, and—well, and—we have nobody but ourselves to thank for this state of things. Taking the week as an average sample of the weeks in the year, it means that we take over a million dollars' worth of electrical apparatus from America out of the three million odd dollars' worth exported. Is it that we cannot make the apparatus so cheaply, or it is that a nation of shopkeepers is beaten at its own business?"

MISCELLANEOUS SCIENCE.

STRAY CURRENTS.

ELECTRIC DISCHARGE ON LIQUID DIELECTRICS.

Some experiments have been carried out by Mr. M. P. Berthelot, in order to determine the action of the silent electric discharge on liquid dielectrics. He says, in the "Comptes Rendus," that dry terebenthene, when subjected to the action of the silent electric discharge, yields a small quantity of diterebenthene, but otherwise remains unaltered. Olive oil yields a small quantity of blackish product, insoluble in ether, oil, and all the various solvents. Except for the difference in color, it resembles the polymeride formed in presence of nitrogen. Alcohol, when the action is prolonged, yields hydrogen and ethane, and the liquid contains some aldehyde and a hydrocarbon, which seemingly contains less hydrogen than the olefines, and has a feeble action on ammoniacal silver nitrate.—Ex.

THERMOPHONES.

The periodic changes of length or bulk produced by an oscillating current may be utilized for the electrical propagation of sound. The effect may be indefinitely increased by superimposing a steady current upon the variable current. A bolometer is inserted in the secondary circuit of a small induction coil. As long as the secondary current alone traverses the bolometer, no sound is heard; but as soon as an independent constant current is made to traverse the bolometer, every impulse of the induced current produces a noise in the bolometer, which, in this case, acts like a telephone. The loudness increases with the strength of the steady current. On replacing the induction coil by a microphone, nothing is heard. But even then the sound may be brought out by Simon's sensitive arc. This, says Mr. Braun, in the "Amal. Phys. Chem.," is due to the strong, steady current traversing the arc. If three or four secondary cells are put in circuit with a bolometer and a microphone, anything spoken into the latter is distinctly reproduced by the microphone. The bolometer may be replaced by strips of thin brass.—Ex.

ELECTROLYSIS DIRECT FROM THE ORE.

A method of depositing metals direct from the ore has been in use for some time in Germany, and has proved so successful that a number of metallurgical works are to be equipped for this process of treating the ore. The process has been applied most for the refining of copper. The ores of this metal are first ground to a fine powder and then placed in a hot solution of copper chloride, the effect of which is to dissolve the copper, silver, lead and nickel, and to change the solution to cuprous chloride. By the action of lime the arsenic, bismuth, antimony, and iron are eliminated, and the solution, after being filtered, is passed into a receptacle, divided by a diaphragm. Here an electrolytic action occurs. The anode being carbon, and the cathode copper, the copper of the solution is deposited in the cathode chamber, while the chlorine set free in the anode chamber combines with the solution to form cupric chloride, which serves to dissolve more of the copper ore. There is no loss of the solution, as the action is continuous. It is claimed for the process that the yield is far in excess of the usual methods, and that silver, lead and nickel are also obtained in a free state.—Ex.

GERMAN ELECTRIC COMPANIES.

According to recent statistics, Germany boasts now of twenty-three industrial or financial companies, in connection with electricity, the capital of each of which amounts to at least 1,500,000 marks, the most important possessing a capital of 47,000,000 marks, while that of six others varies between 24,000,000 marks and 40,000,000 marks, five others range between 10,000,000 marks and 16,000,000 marks, and eight control from 3,000,000 marks to 8,000,000 marks.—Ex.

CALCIUM CARBIDE WORKS.

According to "Invention," there are at present in operation throughout the world thirty-two calcium carbide works, and fifteen in course of construction. Only four of these are in Great Britain, those at the Falls of Foyers, with a producing capacity of about 1,000 tons per annum, being the largest. There is a 400 horse-power steam plant at Cradley Heath, near Birmingham, and a 200 horse-power steam plant at Ingleton. France has ten works and four in course of construction; Switzerland, seven in all, the largest of 6,000 horse-power; the United States has six; Germany, five, the largest of 22,000 tons capacity per annum, and at one of the German works the power costs only £2 per electric horse-power per annum. One of the works in Spain will have an output of 30,000 tons per annum.

View of Engine Room. (The White Building.)

CURIOUS RUSSIAN CLAIM TO AN ENGLISH INVENTION.

Who was the first to discover the electric light? Our belief up to the present has been that it was Sir Humphry Davy, in 1813, but it now appears that it was Vassili Petroff, a Russian professor, who accomplished the deed in 1802. This is what we read in a note in the Russian edition of the "Cours d'Electricite," by Eric Gerard, which has been inserted by the translator, M. A. Chatelain, who calls it an historic rectification. Almost all the electrical books published on the Continent tell us that Sir Humphry Davy discovered the eectric light in 1813, and no one will hesitate in acknowledging that Russia is rather slow in recognizing the services of her scientists, since it took her not less than ninety-six years to become aware of the existence of the 2,400-cell battery, which allowed Petroff to strike the electric arc before Sir Humphry Davy.

In the new southern terminal station, at Boston, there are in use 235 arc lights, enclosed pattern; 6,000 incandescent lights, 1,200 of which are in the main waiting room; 25 electric elevators, 4 electric generators and 45 electric motors.

ELECTRO-PLATING.

GALVANIC DEPOSITS ON NON-CONDUCTORS.

The following is an abstract from Mr. Carl Hering's digest of an article by Knothe, in the "Elektrotechnischer Anzeiger," on the best process for coating objects that are non-conductors: It is hopeless to try and form a metallic coating by chemical means, and the only satisfactory methods are to use graphite or a coating obtained by a solution of silver. The graphite method is briefly described, but is considered inferior to the silver solution method. For the latter a solution of nitrate of silver in alcohol is used, the body being dipped into it or coated with it; it is then placed in the vapor of phosphor or sulphide of hydrogen, which converts the coating into a conductor; the sulphur method is preferred because the coating adheres better and the process may be repeated if not successful at first, while that is not the case when phosphorus is used. The silver solution should be made neutral with ammonia, as it will then adhere better to greasy surfaces and hastens the sulphiding process. With such a coating the first deposit is formed a little more rapidly than with graphite. The object should have one or more copper conductors attached to it to start the deposit; these starting points are best placed in the deeper portions of the object. The object should first be treated so that all pores are filled and that it becomes waterproof; this is done with wax, tallow, or a mixture of the two and collodium; wood is best boiled in linseed oil. The silver solution is made of two parts by weight of silver nitrate, four parts water, five parts ammonia of 0.9 specific gravity, and six parts of absolute alcohol; when the ammonia is added a brown precipitate is first formed, but is redissolved. After being coated with this it should be completely dried and freely exposed to the air for some time; it is then subjected to the action of the hydrogen sulphide; this process may be repeated as often as is necessary. The current for depositing the copper should be only 0.5 to 1 ampere per square decimeter of surface, and at 0.75 to a maximum of 1.5 volts. The copper solution should consist of 3 to 4 parts of water to 1 part of the sulphate and 2 to 8 per cent. of sulphuric acid. The hydrogen sulphide is obtained by pouring dilute sulphuric acid on iron sulphide. A metallic deposit on glass, porcelain, etc., is best obtained by coating it first with gold paint and then firing, after which the deposit can be made. Or the objects may be covered with a coating of wax or resin, which is then coated with a silver solution, as above described. Celluloid may be coated in the same way. Collodium or celluloid may also be coated with a solution of phosphorus in ether-alcohol added to a solution of concentrated silver nitrate; the object is then painted with the creamy precipitate which is formed. It is found that copper salts in place of the silver salts do not give such good results.

AMONG THE SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

26 Cortlandt Street, N. Y. City.

The 131st meeting of the Institute was held at 12 West 31st street, Wednesday evening, January 25th. A paper was presented by Lieut. S. Dana Greene, of Schenectady, entitled, "Electricity on Board Ship." It was discussed by Capt. Millis, Lieut. Walling, J. W. Lieb, Jr., T. C. Martin, Elihu Thomson, Townsend Wolcott, and others.

At the meeting of the Executive Committee in the afternoon the following Associate Members were elected: Royal Bradford Daggett, Marquette Building, Chicago, Ill.; Ernest I. Dyer, Box 28, Yokohama, Japan; Geo. Henry Hill, New York City; Ernest Rowland Hill, Pittsburg, Pa.; Wm. A. Lynn, University of California, Berkeley, Cal.; J. Manley Simpson, P. O. Box 2513, St. Paul, Minn.; Thos. Perrin Thompson, 217 Cumberland street, Brooklyn, N. Y.; Alfred J. Thompson, San Ignacio 50, Havana, Cuba; Robert M. Wilson, 113 Shuter street, Montreal, Que.

The following Associate Members were transferred to Membership: Philander Betts, U. S. Navy Yard, Washington, D. C.; Winden Elwell Goldsborough, Purdue University, Lafayette, Ind.

BUSINESS NEWS.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING JANUARY 24, 1899, $49,815.00.

New York, N. Y., Jan. 24, 1899.—The following exports of electrical material and machinery are from the port of New York for the week ending this date:

Antwerp.—Thirty-four packages electrical material, $3,494.

Africa.—Seven cases electrical material, $604.

Argentine Republic.—Two hundred and ten cases electrical material, $8,661; one case electros, $24.

British East Indies.—Four cases electrical material, $340.

Bremen.—Two cases electrical material, $886.

British Possessions in Africa.—Fourteen cases electrical material, $383.

British West Indies.—Forty-nine cases electrical material, $144.15.

British Australia.—Two packages electrical material, $134.

Brazil.—Twenty-five cases electrical material, $907; sixty-six packages electrical machinery, $1,905.

China.—One case electrical material, $53.

Cuba.—Nineteen packages electric material, $504.

Central America.—Seven packages electrical material, $246.

Copenhagen.—Eight cases of electric motors, $403; two cases electros, $25.

Dublin.—Four cases electrical material, $236.

Genoa.—Seven cases electrical material, $1,520.

Japan.—Ten cases electrical material, $582.

London.—Sixty-eight packages electrical material, $2,594; seventeen packages electrical machinery, $1,940.

Mexico.—Twenty-six packages electrical material, $478.

Milan.—Two cases electrical material, $213.

Newfoundland.—Seven packages electrical material, $641.

Oporto.—Six cases electrical machinery, $375.

Porto Rico.—Twenty-eight packages electrical material, $511.

Sandwich Islands.—Thirteen cases electrical material, $79.

St. Petersburg.—Twenty-six packages electrical machinery, $5,041.

U. S. of Colombia.—Ninety-seven packages electrical material, $2,500.

Uruguay.—Three cases electrical material, $131.

NEW INCORPORATIONS.

Portland, Me.—Hancock Equipment Co. has been incorporated by C. M. Reed, C. A. Cotton and J. A. Desmond; electrical machinery. Capital stock, $25,000.

San Francisco, Cal.—St. Helena Electric Light and Power Co. has been incorporated by J. E. Firmstone, G. W. Crum, L. St. D. Raylane, E. D. Cooley and W. A. Sconard. Capital stock, $30,000.

Bridgeport, Conn.—Swinnerton & Sniffen Manufacturing Co., incorporated by T. C. Swinnerton, C. O. Sniffen and M. T. Sniffen; electrical specialties. Capital stock, $10,500.

Jersey City, N. J.—Middlesex and Monmouth Electric Light, Heat and Power Co. has been incorporated by John Karr, Stirling Birmingham and Henry H. Holmes; to furnish electricity for light, heat and power. Capital stock, $50,000.

Campton, N. H.—Campton Electric Light Co. has been incorporated by M. C. Dole, E. Dole, H. M. Fifield, W. Smith and D. B. Jones. Capital stock, $2,000.

Corunna, Mich.—Corunna Lighting Co. has been incorporated by C. M. Nolley, D. M. Lowe, D. C. Nolley, F. Clark and M. Mead. Capital stock, $20,000.

Los Angeles, Cal.—Woodill & Hulse Electric Co. has been incorporated by H. B. Woodill, B. F. Hulse, Clara T. Hulse, F. J. Woodill, J. M. Rafferty and L. D. Gray; for the purpose of doing electrical contracting. Capital stock, $10,000.

TELEPHONE CALLS.

Amherst, Va.—W. A. Hawkins, of Harrisburg, Va., contemplates the establishment of a telephone system in Amherst.

Savannah, Ga.—The Georgia Telephone Co. will apply for charter.

Chadron, Neb.—The Rauche Telephone Co. has been incorporated by B. Richards, W. G. Comstock and C. C. Johnson. Capital stock, $5,000.

Sidney, N. Y.—Union Telephone Co. has been incorporated by J. D. R. Buckley, E. O. Allen, J. Spickerman and M. S. Siver. Capital stock, $10,000.

Newton Falls, Ohio.—The Newton Falls Telephone Co. has been incorporated, with a capital stock of $3,000.

Chatfield, Minn.—People's Telephone Co. has been incorporated by Joseph A. Ross, George B. Thompson, A. L. Ober, B. W. Huntley and Charles H. Anderson. Capital stock, $50,000.

Princeton, Me.—Lakeside Telephone and Telegraph Co., incorporated by Lemuel Brehant, M. J. Brehant and A. A. Williams; to operate telephone and telegraph lines. Capital stock, $10,000.

Pottey Place, N. H.—Pottey Place and New London Telephone Co., incorporated by J. E. Shepard, F. P. Goss, W. S. Carr, C. E. Shepard and C. E. Carr. Capital stock, $1,000.

New Falls, Ohio.—New Falls Telephone Co., incorporated by S. Thayer and others; to operate a telephone line. Capital stock, $3,000.

New Rochelle, N. Y.—The New Rochelle and Westchester Telephone Co. has commenced the construction of its conduits.

Sherman, N. Y.—The Sherman Telephone Co. has been incorporated by Albert J. Arnold, Charles H. Corbett, Charles E. Sheldon, W. H. Homewood, H. H. Corbett, W. B. Whitney and T. J. Newell; to operate a telephone system connecting the villages of Sherman, Westfield, Mayville and Ripley. Capital stock, $1,000.

STREET RAILWAY NEWS.

Chicago, Ill.—Rockford & Belvidere Railway Co. has been incorporated by H. L. Jewell, W. H. Vorhis, C. B. Wasslich, W. D. Sheahan and F. A. Poor. Capital stock, $50,000.

Allentown, Pa.—The Allentown and Bethlehem Traction Co. will expend $40,000 this spring in rebuilding its trolley road.

Anderwos, Ind.—Congressman C. L. Henry will commence the construction of an electric railway line to Elwood, Muncie and Indianapolis.

Lisbon, Ohio.—An electrical railroad is to be constructed to connect Lisbon and East Liverpool.

POSSIBLE INSTALLATIONS.

Hartford, Conn.—Steps are being taken to construct an electric light plant.

Slaters, W. Va.—The Slater Coal Co. has put in an electric light plant.

Hillsboro, Tex.—Payton & Dayton have commenced work on the construction of their electric light plant.

BUSINESS CHANGES.

Waco, Tex.—The Waco Electrical Co. has increased its capital stock from $20,000 to $30,000.

Hartford, Conn.—Hartford Electric Light Co., J. H. Farrell and G. H. Farrell, gave attachment for $150, in favor of this company.

Hartford, Conn.—Frank Trumbull and John Trumbull, electrical contractors, have made an assignment. Liabilities, $3,334; assets, $466.

New York, N. Y.—The Beacon Lamp Co., manufacturer of incandescent electric lamps at 120 Liberty street and at New Brunswick, N. J., involuntary petition in bankruptcy filed against it.

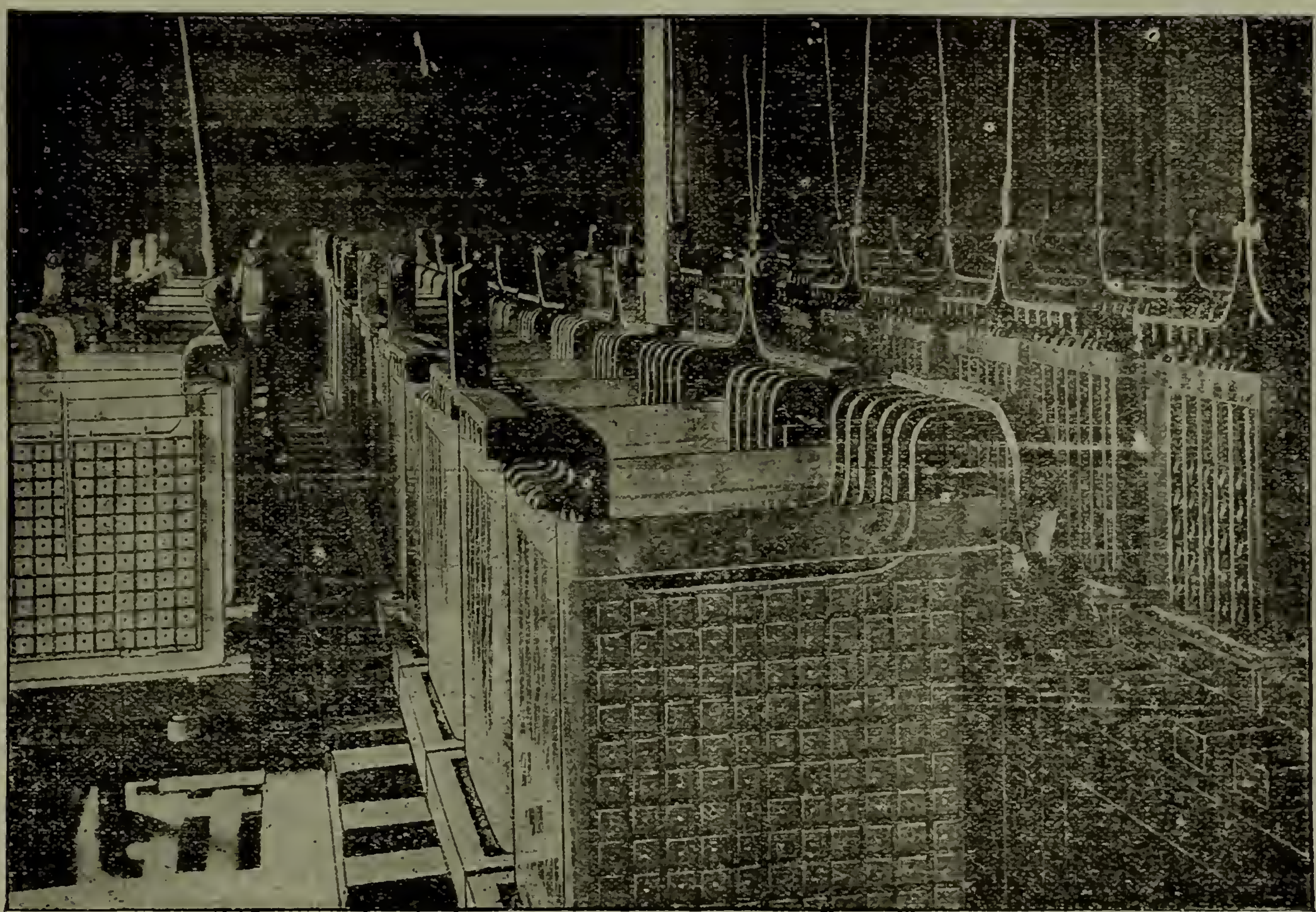
Richmond, Va.—The Virginia Electrical Development Co. has filed a mortgage to the Richmond Trust and Safe Deposit Co., to secure an issue of $1,500,000 first mortgage bonds.

Fort Wayne, Ind.—The Fort Wayne Electric Corporation; bankruptcy proceedings have commenced.

The Electrical Age.

VOL. XXIII—NO. 6 NEW YORK, FEBRUARY 11, 1899 WHOLE NO. 613

THE STORAGE BATTERY.



Storage Battery Auxiliary, Showing Size of Station Cells.

LATEST PROGRESS IN THE APPLICATION OF STORAGE BATTERIES. *

(Concluded from page 63.)

When a storage battery is installed at the power house, and is connected directly in parallel with the generators on the bus bars, some means have to be provided for regulating the voltage of the battery to suit the generators. As you know, railroad generators are overcompounded, the voltage rising as the load increases, while with the storage battery the reverse is the case, the voltage decreasing as the discharge increases. In order to make the battery work properly in parallel with generators of this type and take the fluctuations of the load, keeping the generators constantly loaded, some means of compounding the battery has to be adopted. This is done by using a compound wound booster in series with the battery, which is so designed as to increase its voltage in proportion to the increase of load, thereby enabling it to take its proper share and keep the load on the generators constant.

The following slides show the Buffalo power house, battery room and the booster and switchboard. Also a load curve showing the method of using the battery and the part is plays in the general plan of operation.

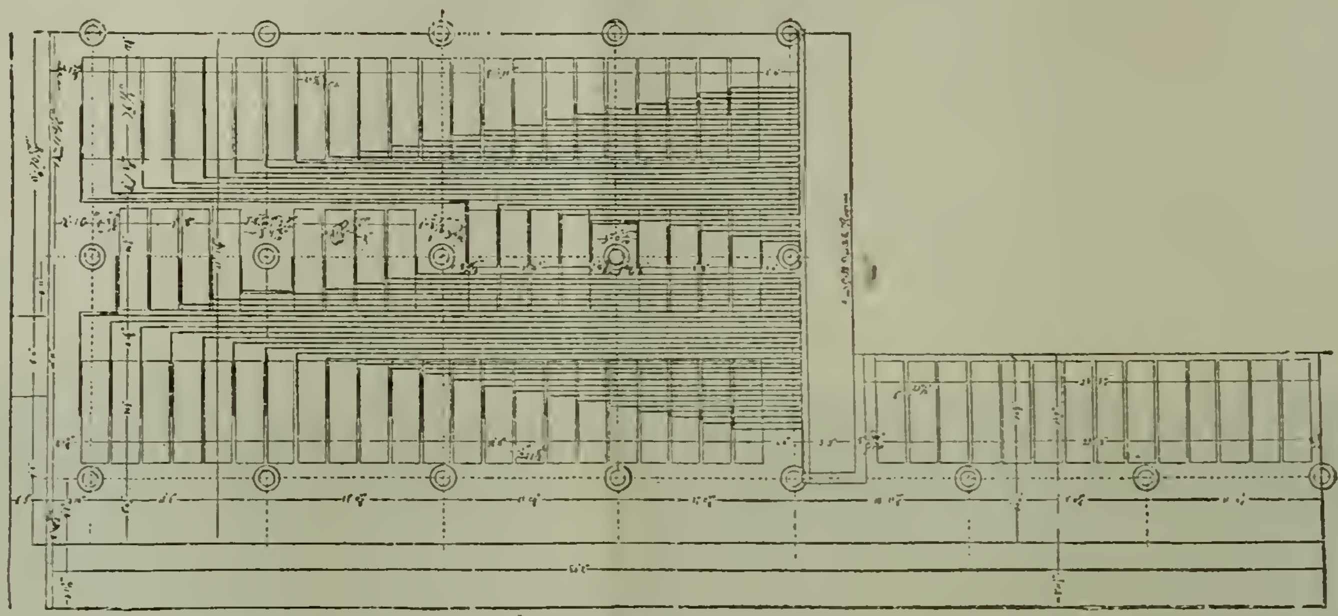
The battery discharges during the morning and evening peak, and is charged between times, and also at night from the Niagara Falls power.

By the aid of the battery they are enabled to make very much more use of the Niagara Falls power. Before they installed the battery they were only able to shut down their steam plant from 11:30 p. m. until 5 a. m., during which time the rotary converters carried the entire load, which averaged about 600 H.P., while they were paying for 2,000 H.P. With the aid of the battery they are enabled to shut down their steam plant from 7 a. m. to 7 p. m., and about eighteen hours on Sunday. In addi-

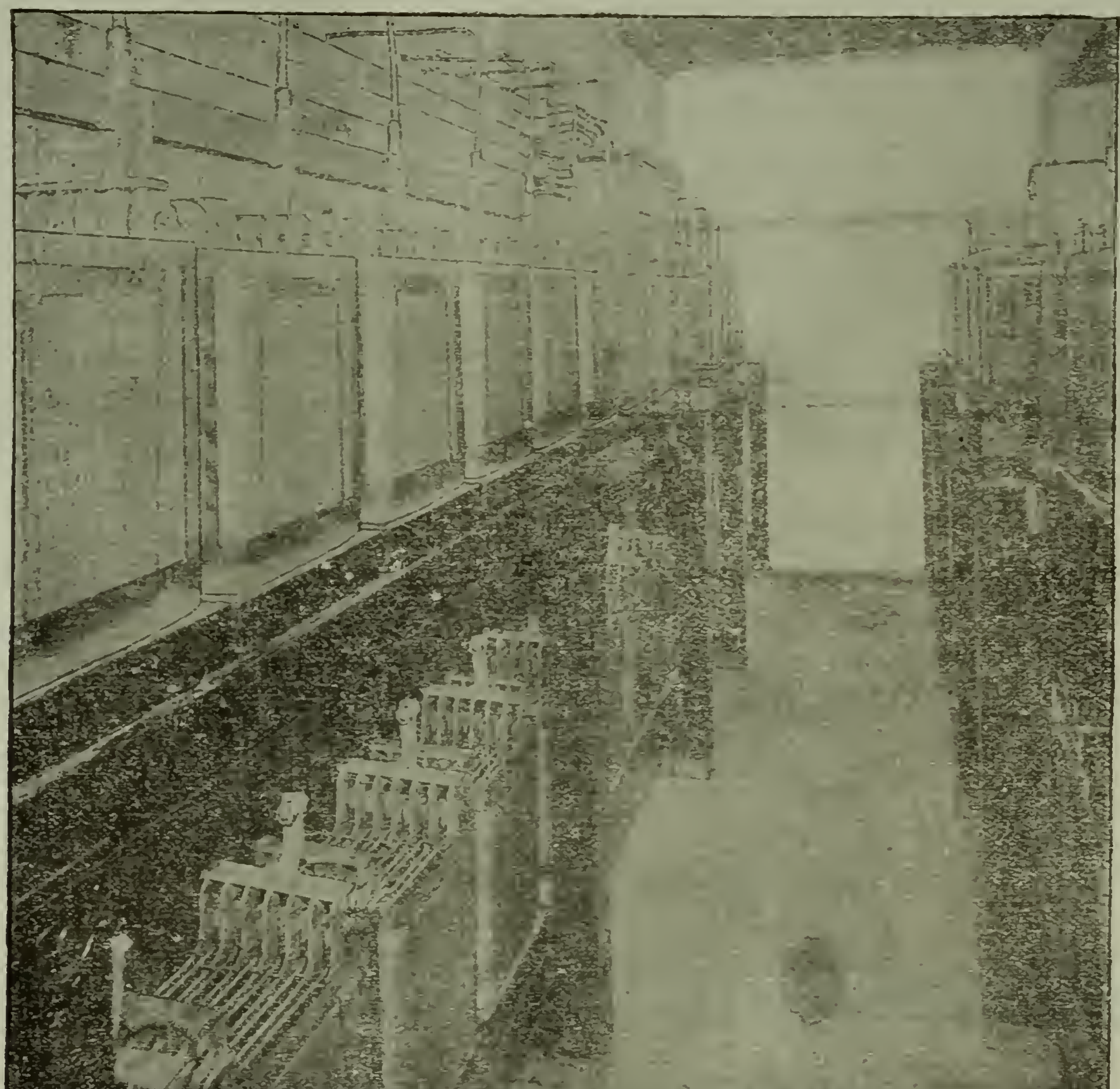
*Paper read before the New York Electrical Society, January 12, 1899, by Joseph Appleton.

tion to this they are enabled to utilize very much more of the Niagara power.

An illustration of the second method of using storage batteries for railroad work is seen in the case of the battery installation of the South Side Elevated Company of Chicago. This company operates an elevated railroad about nine miles long, all their trains being equipped with the Sprague Multiple unit system. The power house is located approximately at the center, and the two storage batteries near each end of the line, and are connected directly across the system without a booster. The charge and discharge of these batteries is controlled by the drop over the feeders from the power house to the batteries, this drop varying according to the load on the system from ten to eighty volts. When the load on the system is light, the drop in the feeders is small, and there is voltage enough to charge the battery. When the load becomes heavy, the drop on the feeders is increased, this consequently causes the batteries to discharge into the line. The method of operating is entirely automatic, the batteries discharging at times of heavy loads, and charging at time of light load, thereby keeping the load on the generating station practically constant. The following slides illustrate these two battery rooms, in each of which are

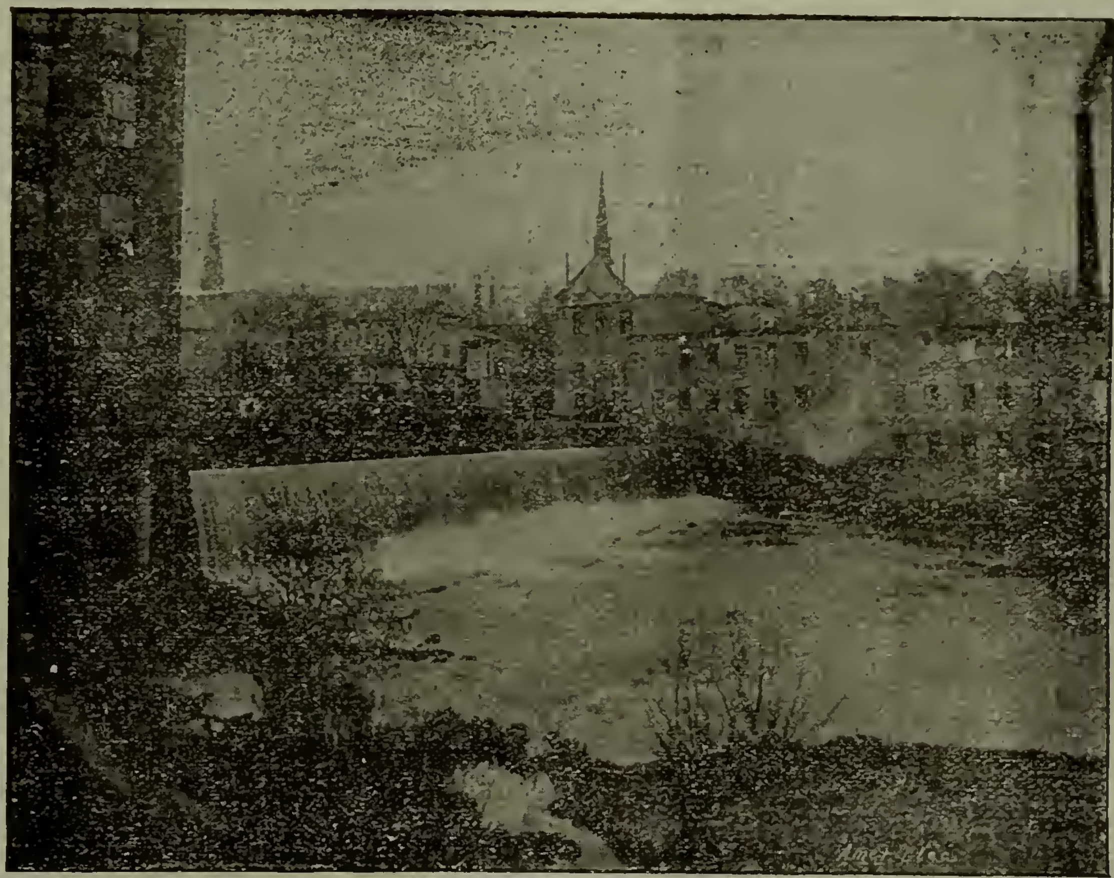


Diagram, with Dimensions Showing End Cell Switch Room.



General Arrangement of Cells to Facilitate Inspection.

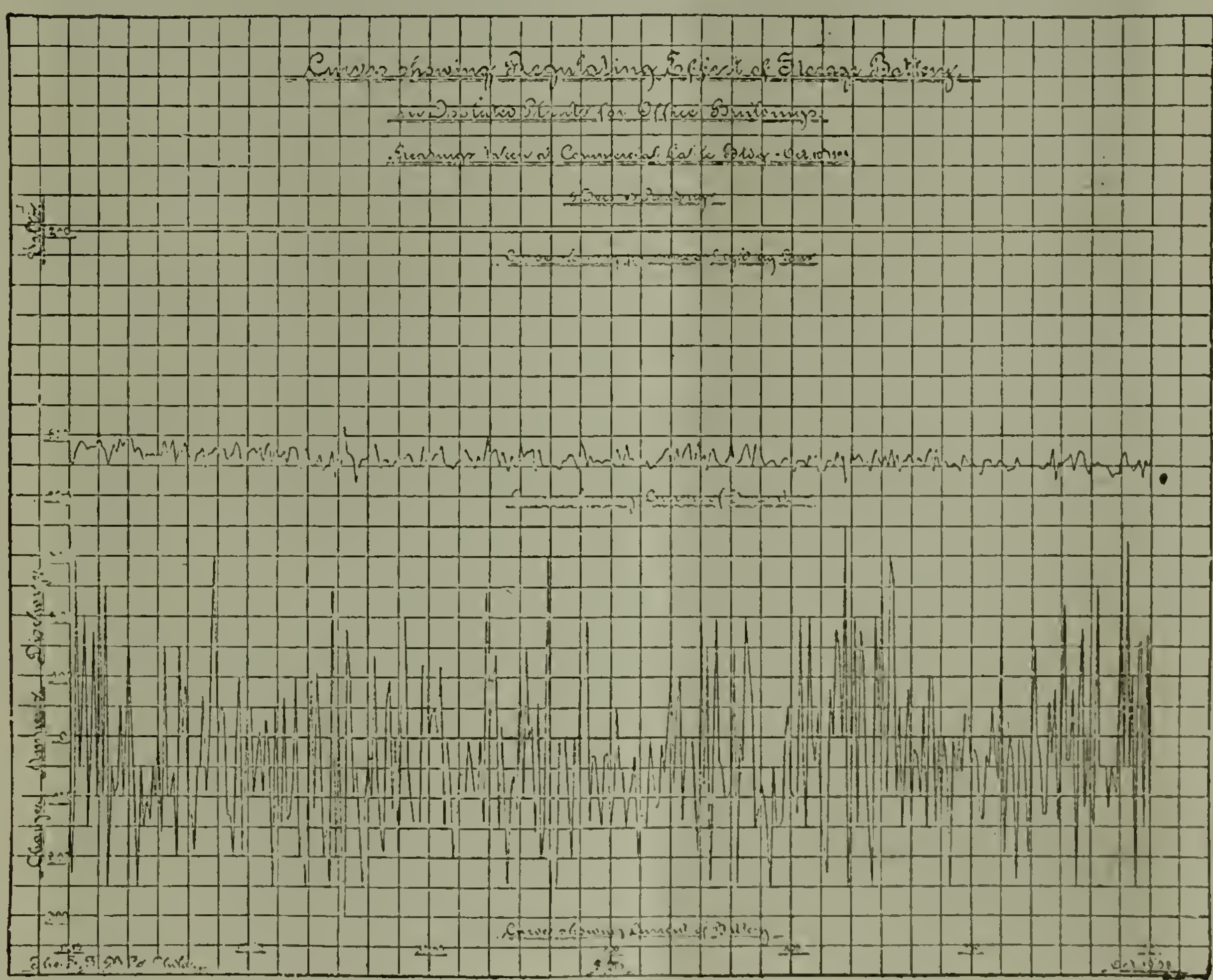
installed 248 cells having a capacity of 1,000 horse power when discharging at the hour rate. The following curves show the result which the batteries have had on their generating plant.



Using Natural Resources for Municipal Purposes.

The first curve shows the load on the generators when they were operating the entire system without batteries.

The second curve shows the load on the generators under the same conditions with the batteries in use.



Curve Showing Regulating Effect of Storage Battery in Large Office Building, New York

The other two curves show the operation of the battery at this time, which is the time of the heaviest load or the "peak" of the system.

It will be noticed from these curves that when the power house was operating without the battery during the peak of the load the maximum load was 7,500 amperes, with sudden fluctuations of 5,300 amperes, while with the batteries in operation the maximum load at the power house under exactly the same conditions was 5,700 amperes, and the fluctuations only 2,000 amperes. Thus, the batteries had increased the capacity of the power house by about 2,000 amperes, and steadied the load on the generators to the extent of nearly 3,000 amperes.

Those acquainted with the operation of railway plants will appreciate such results. The way in which a battery operates under such conditions and takes up the fluctua-

tions automatically, is plainly seen by the curves, showing the readings on the annunciators in the battery circuit.

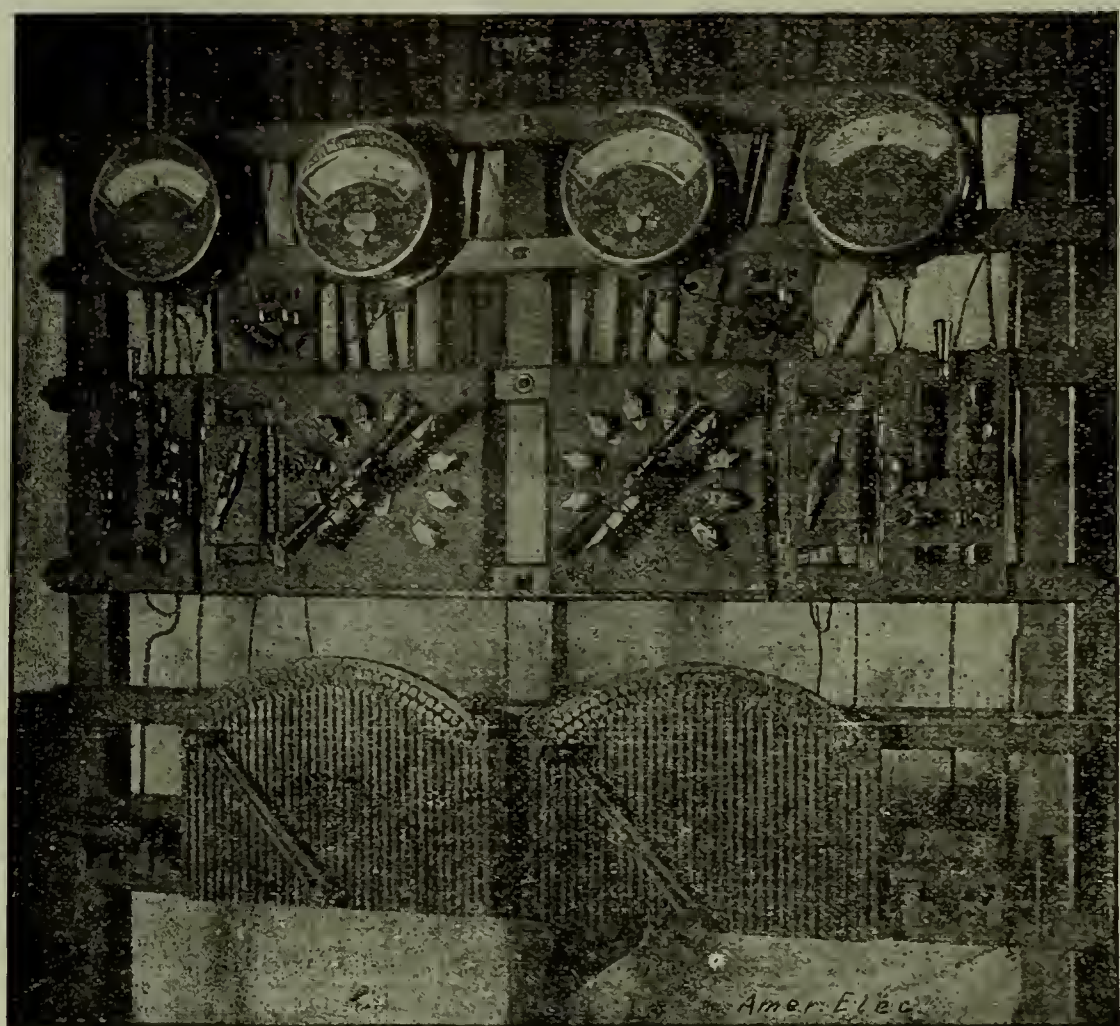
SWITCHBOARD.—ITS SIMPLICITY.

Each battery is connected to the power house by two special feeders in addition to the general system of con-

Record of Load.

ductors, so that the proportion of charge and discharge can be regulated according to the conditions of the load.

If it is found that a battery is being discharged more than it is being charged, an extra feeder is connected between it and the power house, so that it will be relieved



Switchboard Appliances for Storage Battery Installation.

of a portion of the load. By this means a very complete control can be maintained of the battery from the power house, and the most efficient method of operation secured.

A battery installed at the end of a line in this way, not only increases the capacity of the power house and saves the investment in copper by making it only necessary to transmit over the feeders the average amount of current required, instead of the maximum ; at the same time maintainig the proper voltage at the end of the line, thereby enabling the motors to run at the point of highest efficiency. Of course the line must be long enough to justify the use of a storage battery and to supply sufficient drop in voltage over the feeders to make the battery operate automatically as the load varies.

A variation in voltage at the end of the line, between conditions of maximum load and minimum load of 10 per cent., is ample to make the battery self-regulating, and take care of the fluctuating load without a booster. The following figures taken from a storage battery installation of this description, installed some two years ago,

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NEW YORK, FEBRUARY 11, 1899.

CONTENTS:

THE MISUSE OF X-RAYS.

Occasions in life arise when the necessity for decrying certain novel processes becomes more than a passing impression. The Boston Transcript publishes the following piece of scientific information, regarding printing by X-rays:

"George Izambard, who has been experimenting in Paris with the Roentgen rays, in the hope of adapting them to commercial use in the printing industry, announces that he has succeeded in producing a machine for the purpose. He reasoned that if the X-rays would penetrate oaken logs they ought to penetrate piles of paper, and that as photographs could be taken with X-rays, it ought to be possible to reproduce a picture or printing through every sheet of a pile of paper. The invention is so far matured that M. Izambard is able to expose a pile of paper between two Crookes tubes and print both sides of all the sheets in the pile at the same time. He can also place a series of piles of paper around a Crookes tube, making use of the X-rays by radiating them from a center. It was suggested many years ago that the printing of the future would be done by electricity, operating, not on single sheets, but on all the sheets of a pile at the same instant.

"Various inventions have made some approach to a solution of the problem, but none of them has been successful in producing satisfactory printing. M. Izambard's first success was obtained by sensitizing the paper, on the side that was to be printed, with a gelatino-bromide emulsion, such as is commonly used in photography. A pile or block of paper thus prepared was placed in a position of exposure to the X-rays. On top of the paper was placed a copy of the thing to be printed. This copy being proof to the X-rays, in a trice the thing was done, and on developing the pile of paper the inventor found a copy clearly printed on each sheet. To print in this manner, it is necessary that the copy or original shall be nearly impervious to the Roentgen rays, and that it shall be placed between the Crookes tube and the pile, where the rays may be directed to it.

"The copy is preferably first printed or written in what is called radiographic, or X-ray, proof ink, composed of a material calculated to intercept the rays. A few seconds' exposure is sufficient to effect the printing through the entire pile of paper, but it is at first invisible and requires to be developed or fixed, after the method of a photographer. The piles of exposed sheets are trundled into a red-light room and suspended in vats, where the developing and fixing liquids are applied. Rinsing and drying follow, and the latter may be hurried by mechanical and chemical means. It is apparent that the process is really a sort of wholesale method of photography with the X-rays, and is printing only in the photographic sense of the term.

"The X-ray proof ink used is made in part of finely divided metallic or calcareous powder. Bronze, copper, white lead, or white zinc may be used. As a writing ink, white lead in a solution of gum has been found most satisfactory. When the matter to be printed is first typewritten, the metallic powder is mixed with boiled linseed oil."

The public are frequently misled by such important discoveries. Judged, practically, neither the press nor the public will ever gain much by such a departure. A slight calculation will quickly show the difference between expectations and result. Electric power, Crookes tubes, coil, and photographic apparatus, are not of a family that a printer becomes quickly acquainted with. As for expense, a visit to the press room of a metropolitan newspaper during rush hours, will answer that question most comprehensively.

Our literature will not be produced by X-rays this year, nor for many decades to come, unless, like Keely, M. Izambard offers a preliminary inducement of the etheric force species.

COPPER.

An important item of expense to electrical manufacturers is copper. To the large concerns, any rise or fall in price for a fixed period has a marked effect upon the yearly dividends. The fluctuations in price are more to be feared than a uniform figure. The following statement taken from the nineteenth annual report of the United States Geological Survey, issued at Washington, is of interest to the trade: "There is clear evidence that, in response to the temptations held out by years of prosperity, the copper mining industry of the United States is entering upon a period of steady expansion. Long established and successful corporations are in many cases perfecting and adding to facilities and equipment for an increased output."

From the years 1845 to 1897, the production has steadily increased from 100 to 220,571 long tons. A sudden increase took place between the years 1880 to 1897 of from 27,000 to 220,000 tons, a period coincident with the application of electrical appliances, as may be noted. Wire manufacturers particularly should feel pleased at the outlook.

The railroad to Jerusalem is to be succeeded by a trolley to the Pyramids. Presently, the prophetic language of Mr. Punch, uttered thirty or forty years ago, will be realized: "Thebes, Thebes, Sir! Steady! Now where's that party for Engedi?"—Ex.

will show the advantages from a commercial point of view.

The conditions were as follows: The length of this line at the end of which the battery was installed was 7 miles from the main power house, running into the suburbs of a large city. The increase of traffic on this line warranted its extension 4 miles further, making a total of 11 miles from the power house. When the extension was made, it was found that the feeders were quite inadequate to carry the increase of load, and it was necessary to provide additional power at the end of the line, either by laying additional feeders, installing a small power house at that point, or putting in a storage battery sub-station. Each method was carefully considered, and the following figures show the result. If additional feeders were laid of sufficient sectional area to provide the proper working voltage at the end of the line, the cost would have been $273,000, figuring on the basis of $1 per foot, laid for 1,000,000 c. m. feeders. This was of course prohibitive. The cost of a small power house of sufficient capacity to take care of the load in that section of 750 kilowatts would have been $85,000. The cost of a battery sub-station complete, including real estate, was $33,000, or a saving of $52,000 over that of the power plant.

The cost of operation has proved exceedingly satisfactory, showing a saving of some $1,350 per month, or $16,000 per annum over the cost of operating a power house of such a size. The cost of operation includes all attendance, taxes and depreciation and interest.

One of the most interesting and important storage battery installations recently made is that in connection with the underground trolley system of the Metropolitan Street Railway Company of this city. Their system covers a large area, and they have utilized storage batteries in sub-stations, two are now in operation, one at the foot of West Twenty-third street and the other at Thirty-second street and Fourth avenue.

By the kind permission of the Metropolitan Street Railway Co., any of the members of the New York Electric Society and their friends, who care to do so, may inspect the Twenty-third street plant after the meeting to-night.

I will briefly outline the plant and method of operation and will leave the details until we are on the ground. The battery consists of 540 cells, each containing 51 plates, 15 inches square. The dimensions of the cells are 4 feet by 21 inches by 24 inches. The battery is divided into two sections, 270 cells in each, which are operated in parallel. This is done to keep the sizes of the cells within practical limits and to enable them to be more easily inspected and cared for. A cell 8 feet in length, which would be the size if but one battery were used, is too large to be satisfactory. The capacity of the complete battery is 8,000 ampere hours, with a one hour rate of 4,000 amperes.

The function of this battery is to take care of a portion of the morning and evening peaks, and to take up the fluctuations of load at all times. The method of operation is as follows:

Sufficient cells are provided so that the voltage of the battery just balances the average voltage of the system; consequently when the battery is connected to it, it acts as an equalizer and does not charge or discharge except as the fluctuations occur. When the battery discharges on a peak and is being charged during the hours of light load, a booster is connected in series with it to regulate the amount of a charge and discharge. The output of the booster and consequently the charge and discharge of the battery is controlled by varying the strength and polarity of the shunt field. This is done by a special form of switch which makes the operation very simple. This slide shows the switch and also a switch board, which is very similar, although not exactly the same. The daily work of the battery is about as follows:

Gas Engine and Generator for Charging.

From 7 to 9 a. m., it discharges on the peak. From 9 to 12 it floats on the system as an equalizer. From 12 to 3 or 4 p. m. it is charging. From 4 p. m. to 8 p. m. it discharges on the peak. From 8 to 12 midnight, it is floating on the system, and after midnight the battery is given its principal charge, this being continued until the battery is full.

This will give an idea of the installation and of the general plan of operation. I will go more fully into the details when we visit the plant.

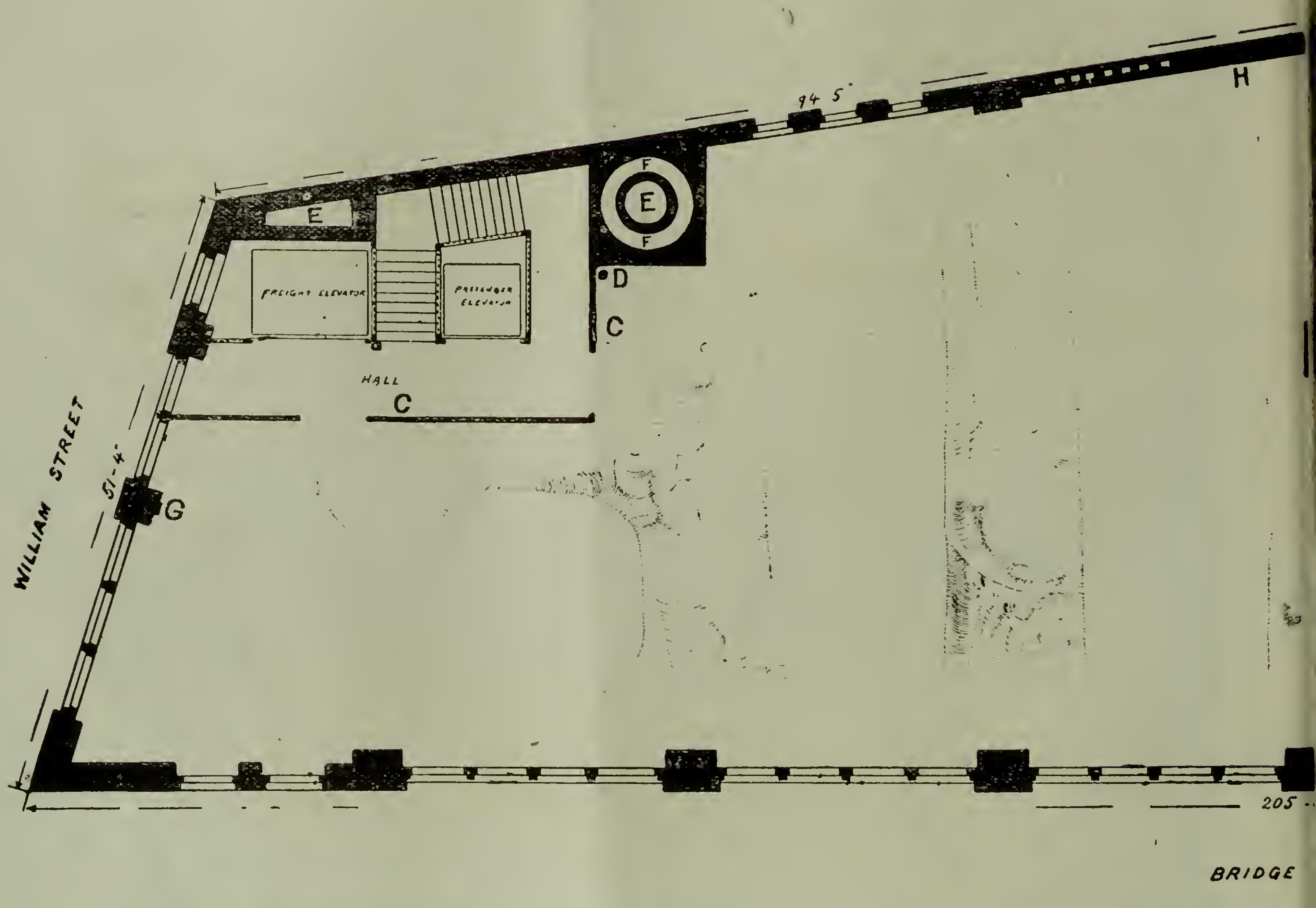
We will now consider the use of

STORAGE BATTERIES IN CONNECTION WITH ISOLATED PLANTS IN LARGE OFFICE BUILDINGS AND STORES USING ELECTRIC ELEVATORS.

The modern office building with its fifteen or twenty stories, together with the demand for quick elevator service, has greatly increased the use of high speed electric elevators.

METROPOLITAN REALTY BUILDING,

214, 216, 218 William St. and 18-20 Rose St.

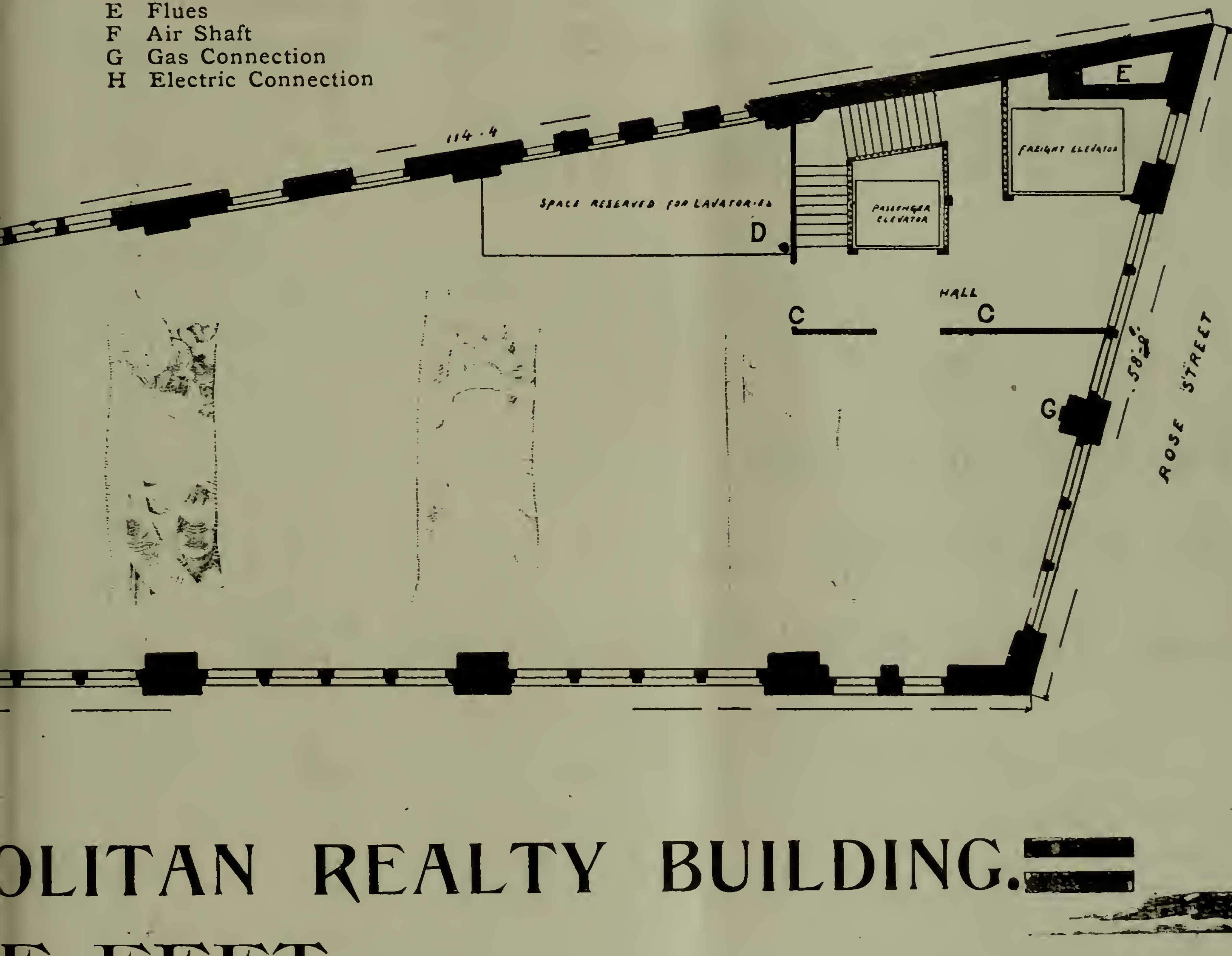


FLOOR PLAN OF THE METR

10,000 SQU

10th and 12t

A Watchman's Clock
C Fire-Proof Partitions
D Fire Hose
E Flues
F Air Shaft
G Gas Connection
H Electric Connection



OLITAN REALTY BUILDING.

E FEET.

loors to let.

The nature of the work the elevator has to reform, and the fact that the power required to start it is from two to three times the hoisting power, cause the elevator load to be an extremely fluctuating one, no matter how carefully the operation is watched.

The Commercial Cable Building in this city is an excellent example of what can be done with the operation of an electric plant of this description. The building is wired for about 3,500 16-candle power lamps, 240 volts, and has six screw type high speed Sprague elevators. The generating plant consists of two 300 horse power water tube boilers, two 225 horse power engines directly connected with two 150 kilowatt generators, and the storage battery consists of 120 cells, each containing 27 plates, 15 1-2 inches by 15 1-2 inches. The capacity of this battery is as follows:

At 260 amperes, 1,620 ampere hours; 520 amperes, 1,040 ampere hours; 650 amperes for the one hour rate.

The function of this battery is to take care of the fluctuating elevator load during the daytime, when the plant is running; that is, between 9 a. m., and 9 p.m., and at night to supply the whole current required for lighting, and the occasional trips of one elevator.

Before the battery was installed it was found necessary to run one generator for the lighting circuit and one for the elevator curcuit, the fluctuations of the latter causing the lamps to be unsteady if both were run from the same machine. The method of operation is as follows:

The elevator circuit is connected directly across the terminals of the battery and the battery is being constantly charged by means of a constant current booster, which boosts the current from the lighting generators. By a special winding on this booster, the amount of current which it allows to pass from the generator to the battery and elevators is maintained practically constant.

For example, with a fluctuation of 600 amperes in the elevator circuit, the load on the generators is increased by about 50 amperes, or less than 10 per cent., this amount having no effect on the steadiness of the lamps. The amount of the current boosted in this way is the average elevator load for the time the plant is running, plus the amount of current required to charge the battery after it has carried the previous night's entire load.

The following curves show graphically the operation of this plant. The lower curve shows the fluctuating load on the battery, which varies from 350 amperes discharge to 300 charge. Of course, when there is no elevator load, which occasionally happens (all the elevator standing still) the entire amount of current passed through the booster is used for charging the battery. When a heavy elevator load comes on this boosted current is diverted from charging the battery into the elevator circuit, the battery discharging in parallel with it as may be required. In this installation the booster is passing about 250 amperes; thus when the battery was discharging at 350 amperes, the total elevator load was 350 plus 250, or 600 amperes. The second curve shows the variation of load on the generator at the same time. This, you will notice, reaches the maximum of 70 amperes, while the voltage on the lamps is maintained practically constant, the curve being almost a straight line. Such an application is an ideal one for a storage battery, as it not only decreases the size of the generating plant required, but enables the generating plant, when it is running, to be operated at a steady and economical load, instead of a fluctuating one.

The centralization of generating plants, and their location in districts where the facilities for obtaining coal and water are good, has developed the system of high tension alternating transmission and the distribution of direct current through rotary converters; this seems to be the one which will be employed in most of the large engineering undertakings to be solved during the next few years. The advantages of direct current for distribution over the alternating, are so marked, that at least until further improvements are made in alternating current distribution, the direct current will undoubtedly be the one most generally used. With this system of large central power houses and sub-stations for distribution through rotary converters, storage batteries are almost essential. They reduce the size of the generating plant in the first place, and also the size of the rotary converters, and enable them both to be operated with a much greater load factor than would be possible without.

The installation of the Hartford Electric Light Co., with which you are probably familiar, was the first of this description in this country, and has proved the many advantages which were claimed for such a system.

An interesting application of this sort has recently been made on a small railroad plant in Montpelier, Vt. This plant was, I believe, the first railway plant in this country operated exclusively from rotary converters with a storage battery auxiliary. The line operated is about nine miles long, and the sub-station is located about three miles from one end. The power is furnished from a power house on the Winooski River, the current being generated by three-phase alternators at 2,200 volts. This current is carried to step-up transformers and is raised to 6,300 volts. At this pressure it is carried to the sub-station, a distnace of eight miles. In the sub-station step-down transformers reduce this to 480 volts, at which pressure it is fed into the rotary converter. The capacity of this converter is 160 kilowatts, and is specially wound for running directly in parallel with a storage battery, its characteristic curve being similar to a shunt wound generator. That is to say, as the load increases, its voltage would fall. By this means the battery will take care of all fluctuations, maintaining a fairly constant load on the rotary. The battery consists of 248 cells, each containing 11 plates 10 inches square. The one hour rate of this battery is 200 amperes. The following curves show the total current of the line, the load on the rotary and the work done by the battery. You will notice that the maximum load on the line during this time is 300 amperes. Of this, the rotary carries 125 and the battery 175. The greatest amount of variation of load on the rotary is 50 amperes, while the variation of load on the line is nearly 300 amperes. Such an installation shows clearly the advantages of battery regulation on a fluctuating load. The size of the rotary is reduced by practically one-half and the load on it kept almost constant.

Most of the plants dealt with to-night have been those of a large size, supplying a large amount of energy. It must not be imagined that storage batteries are applicable only to these large stations. The results obtained from their use are just as satisfactory in the case of smaller stations, but I have referred to the larger ones to-night, as being of more interest. I will, however, give the results obtained in one of the smaller type.

The Claremont Electric Light Plant, Claremont, N. H., is a small plant operated by both water and steam power. The plant consists of two Edison bi-polar dynamos running on a three-wire system, and an arc light service supplied by 50 lights and Thomson and Houston dynamo. In connection with the Edison dynamos, which are operating on the three-wire system, there is a battery plant of 134 cells, containing 11 plates in each cell, 10 inches square. These batteries are operated directly in parallel with the Edison dynamos and relieve them of a portion of the load during the time of heaviest amount. They also help out the steam plant, enabling the water power to be used to its fullest advantage.

Take for example, the following figures for the month of January, 1896: Before the batteries were installed it was found necessary to run an auxiliary engine 180 hours to supplement the water wheel. During the same month in 1898, after the battery was installed, the same condition as regards water power prevailing, the station load was 33 per cent. heavier and it was only necessary to run the auxiliary steam engine 133 hours during the month.

In addition to this saving, the service given was far superior, owing to the steadier pressure which was maintained. The battery has also enabled them to reduce their staff; the entire force employed in this plant now consists of a superintendent, a dynamo attendant and a lineman. The lineman also attends to the lamp trimming. Before the battery was installed there was, in addition, an engineer, while the average load was considerably less than at the present time.

The following slides illustrate the water power and battery room and the battery switchboard. It will be seen that this plant is not elaborate, but nevertheless satisfactory results are obtained, which show that the storage battery will result in satisfactory saving in stations of this sort in just the same, if not a greater degree, than large modern central stations.

There is one application of storage batteries in connection with central stations, which, I believe will in time become very general, but which at the present time, has only been tried in a few instances. It is the use of storage batteries in office buildings, stores, etc., instead of the usual isolated plant or direct supply from the central station. The method of operation is as follows:

During the few hours of maximum load at the central station the storage battery supplies the entire current for the building, it being disconnected from the street mains. During the hours of light load, the building is connected with the street mains and the battery charged from them. By this means the central station can take as customers these buildings, and only have them on their system dur- the hours of light load. This is a class of customer which is not profitable for the central station in the ordinary way, as they have a large number of lamps which are only used for a short period, and that at a time when the station has its maximum load. This means that they have to provide capacity for these lamps, and yet the plant is only needed for an hour or two each day. In one installation of this sort the electric light company, say that they can charge the battery at a time when they are glad to sell current for 4 1-2 cents a kilowatt hour, and it takes a load off their system at a time when current is worth 13 cents. This leaves a good margin for profit for both user and electric light company. The cost of such a battery plant is less than the isolated plant would be for the same capacity, and occupies very much less space, which in some buildings is an important matter. By this method the central station can also take customers having a fluctuating power load, without feeling its disturbing effect on the system, the battery maintaining an even pressure at all times. This is particularly advantageous when the fluctuating load is some distance from the power house, and the feeders are not large.

TELEGRAPHING WITHOUT WIRES.

REMARKS BY DR. LODGE.

Dr. Oliver Lodge, in a reecnt paper before the Institution of Electrical Engineers, speaks of the probable importance of leakage currents in the usual methods of telegraphing by magnetic inductance through space. This form of wireless telegraphy has usually been accomplished with long parallel wires on poles and ground returns. In some experiments made by Stephenson near Edinburgh horizontal coils of wire were used and signals transmitted half a mile, with a Morse key in one coil, and a telephone receiver in the other. Mr. Lodge used similar coils, covering areas of about 4,500 square yards, and transmitted signals about two miles. The characteristics of his methcd are the use of an alternating current of a rather high frequency, about 380, and the tuning of the line to this frequency by the use of condensers, that is, the balancing of the inductance so that the current becomes equal to the induced E. M. F. divided by the ohmic resistance. As a result, he gets much greater effects than where the current is principally determined by the inductance of the circuits. This he shows by mathematical determination will be the case, the value of 2nx the frequency, coming in one instance in the denominator, while in the other it comes in the numerator of the expression giving the ratio between the secondary current and the impressed primary E. M. F.—F. C. C., in Science.

MISCELLANEOUS SCIENCE.

STRAY CURRENTS.

ELECTRO-CHEMICAL ESSAY.

The Swiss Society of Chemical Industry offers a prize of 2,000 francs for an essay that will promote electrochemical interests in Switzerland. Essays must be sent by May 1, 1900, to the president of the society, Mitlodi, Switzerland.

A CURIOUS LIGHTNING EFFECT.

An extraordinary accident is reported to have recently happened to the Johannesburg mail train. During a heavy thunderstorm a flash of lightning struck the engine, with the result that the electric staff used on the engine was partly fused and rendered useless. The train was shortly afterward brought to a standstill.—Ex.

AMERICAN RAILWAY MATERIAL FOR EGYPT.

The Westinghouse Electric and Manufacturing Co. in Pittsburg, has taken orders for fourteen cars and other electric equipment for a street railroad in the city of Cairo, in Egypt. It is proposed, in connection with this road, to build a line from Cairo to the Pyramids, and later another from Cairo to Alexandria.

WIRELESS TELEGRAPHY EXPERIMENTS.

The English papers state that arrangements are being made under the direction of Signor Marconi, at the South Foreland lighthouse and on board the South Goodwin lightship, for a series of experiments, in wireless telegraphy. If the experiments are considered satisfactory, it is stated that the wireless system will be adopted forthwith as a means of communication between the South Foreland lighthouse and the South Sands Head lightship. The points of communication are about three miles apart.

CALCIUM CARBIDE.

Prof. Moissan states, in the Comptes Rendus, that when calcium carbide is perfectly pure, in which condition he has recently prepared it by reducing pure calcium hydride in a bed of pure amorphous carbon, it is quite white and forms white scales, which are seen to be transparent when viewed through a lens. The presence of the least trace of iron is sufficient to color them. The brownish color of the commercial calcium carbide is due to the presence of this metal.

A USE FOR LOW TEMPERATURES.

At a recent meeting of the Royal Society, says the London Engineer, Prof. Dewar showed by a simple experiment, how useful the low temperatures now procurable can be made for exhausting vacuum tubes. By dipping the end of a closed tube filled with air into liquid hydrogen, the air quickly condensed at the bottom in a solid form. It then only remained to separate from the rest that part of the tube from which the air had been removed, by heating and sealing off, and the tube was found to possess an extremely high vacuum. In fact, so perfect was the vacuum that it was difficult to pass an electric current through it. One great advantage of this mode of procedure is that in the above cases only one minute was taken to obtain the required result.

PRODUCTS OF THE ELECTRIC FURNACE.

ELECTRIC SMELTING.

As one having had extensive experience in the use of electric current for heating and metallurgical purposes, I may be permitted to make some remarks upon the subject.

Ahearn's, and all the other electrical heating devices, so extensively used in the heating of street cars, cooking utensils, etc., convert the electrical energy into heat, by sending the current through a resistance, consisting of iron, German silver, or other wire or strips of high resistance. Their patents are based upon the various methods of insulation and protection of the coils from oxidation effects of the atmosphere. One of the earliest was Burton's, consisting of a simple iron wire, zigzagging across a frame, which was then buried in powdered fire clay. It made a very good and effective heater.

But none of these devices could possibly produce a temperature suitable for smelting purposes, as the wires being themselves metal, would also melt.

The neatest way to smelt electrically, consists in using black lead or plumbago crucibles, which, being conductive to the electric current, and of high resistance, may be made the means of producing the heat within themselves. It is simply necessary to stand the pot on a heavy copper plate connected to one pole of a dynamo, another copper plate acting as a cover for the pot, which should fit neatly, and to which the other pole of the dynamo is attached.

Of course, anyone conversant with electrical matters understands that the heating effect is a result of the quantity of current sent through, more than the pressure or voltage. It, therefore, becomes necessary to have a current of high amperage and low voltage. If an alternating current be available, this is readily obtainable by means of a special transformer. The welding outfits of the General Electric Co. are available for this work, the plumbago pot taking the place of the piece to be welded.

I have smelted in such a pot with direct current by placing the pot in series with the lighting system of lamps (incandescent) and varying the current by turnings lights on or off. Magnetite, otherwise infusible, may be melted in this way. In such smelting as I have described, the heating of the charge is by radiation, the same as in a muffle furnace.

Moisson, the French experimenter, uses more largely. I believe, the pot as one pole, and a thick carbon rod immersed in the charge, as the other pole. In this case the charge, if not conductive, must be made so by the addition of charcoal powder.—Marcus Ruthenburg, E. E., Silver City, N. M., in the Mining and Metallurgical Journal.

CENTRAL STATIONS.

PROFITS OF ALTERNATING CURRENT CENTRAL STATIONS.

By T. M. Meston, of St. Louis.

The most interesting problem confronting central station managers is how to increase the net revenue of the plant so as to make a more satisfactory balance sheet to present to stockholders at the annual meeting. Any line of policy that promises to result in a larger gross revenue without adding in the same proportion to labor and expense is consequently a gain in net profits.

The most important debit items in any central station are interest on investments, taxes, salaries and maintenance of pole lines. These charges are fixed by the conditions surrounding each individual plant, and do not, in any case, permit of being reduced to an extent that would materially affect the results of the year's business. Many managers, very properly, will not consider reducing some of these charges, even as far as possible, feeling that too great economy in the matter of salaries and maintenance would be unwise policy for reasons that need not be entered upon at this time.

The writer has watched the development of alternating-current central stations with a great deal of interest, and is more and more impressed with the fact that most stations allow a great deal of revenue to escape them by lack of intelligent efforts to secure customers that are easily within their reach. The only practical remedy lies in the establishment of day circuits for power users in connection with intelligent and persistent canvassing to see that the merits of electric power are understood by all classes of people who can use power.

Many managers will stop here and say, "This is all very well in theory, but I have tried it and the results compelled me to abandon the project." But in spite of this view a day circuit can be made to pay in almost any town of over 5,000 inhabitants. The opportunities for this power business are almost unlimited, but, like every other good thing, it requires hard work to start it going. Once started, it will, like the proverbial snowball, continue to grow from its own momentum.

Some of the uses that occur to the writer are: Clothing factories, family sewing machines, dentists, lathes, jewelers, doctors (for operating Holtz machines), coffee mills, forge blowers, organ blowers for churches, pumps for houses where water supply is taken from wells and stored in tanks. Probably there is not a single station manager who cannot think of as many more right within his reach. A great many managers will say, "We run a 500-volt circuit for this purpose," but upon reflection they will see that this is at best a subterfuge, and is the most expensive way of attaining the results desired.

The greatest economy can only be procured in any business by reducing everything in connection with that business to a standard as far as possible. This point is now being recognized by central stations in the large cities, and what is probably the largest single-phase station in the United States is running all classes of service from the same machine. This company operates incandescent light, series arc and power all from the same machine, and is intelligently pushing its power business, paying special attention to small users, as they can often be supplied with sufficient power for their needs without changing transformers, wiring, etc. Every small motor thus added is a source of revenue which is practically net profit.

A few years ago this plan would not have been practicable, owing to the lack of a reliable single-phase motor. This objection can no longer be raised, as several makes of these motors are now on the market, and they are, in many ways, better than direct-current motors.

For small purposes the simple induction type is probably the best, as the absence of commutator renders them particularly suited to operation by inexperienced persons. The drawback to this type is that the load must be thrown on after the motor has reached speed, or the motor must be given a little assistance at start. This objection is practically negligible in sizes under one-half horse-power. Sizes one-half horse-power and over must be provided with some automatic starting device, usually consisting of a commutator which is short-circuited after the machine reaches speed, when the motor will carry a full load running as an induction machine. As the commutator is used only five or ten seconds each time the machine is started, the trouble it might cause is practically eliminated.

Another great advantage over 500-volt circuit lies in the freedom from danger, which often deters the layman from taking advantage of electric power when he can only procure it in the 500-volt form.

As an incentive to the week-kneed brother to look into this matter, the writer will say that he was much surprised to hear of a manager in a remote Texas town of less than 4,000 inhabitants who was running a day circuit in the summer. The writer expected, of course, that the venture would be a failure, but the man engineering the matter was a true hustler and he kept at it actively for about four weeks, and after that time his day circuit was a paying feature of his plant. This, of course, was only a summer circuit, but it was in a town of extremely small size. In view of this instance will any manager of a plant in a town of 10,000 or over maintain that he cannot make profit on a day circuit all the year round?

The only additional expense of a day circuit is coal and day attendance, the main items of cost not being affected at all.

Our grandfathers did not feel the need of kerosene and electric light until some one had educated them to appreciate better things, and central station managers must educate the layman to depend on electric motors instead of less adaptable sources of power.

The writer believes that along the lines indicated above lies the solution of the success or failure of every alternating-current station, and would be pleased to see some active discussion of this matter conducted by some of the trade papers.—Electrical Era.

ELECTRIC RAILWAYS.

THE DEVELOPMENT OF ELECTRIC RAILWAYS IN THE UNITED STATES.

To what extent electric railways have been developed in the United States, where, admittedly, they have prospered in a manner unparalleled elsewhere, is shown in a short chapter of statistics given in the annual report for 1897 of the United States Commissioner of Patents. The first electric street railway in the United States was put in operation only a little more than ten years ago. In 1880, of the 2,050 road miles of street railway in the country, nearly all employed animal power. Electric power had not yet come into use, but a few miles of lines were operated by steam and by cable. The total number of persons then employed on American street railways was a few hundred short of 12,000. Ten years later, in 1890, the United States census gave the number of street railway employees as 37,434, and at the close of that year the total mileage of street railways all over the country was given as 8,123 track miles, on 5,661 of which horses were used, while the remaining 2,462 miles were worked mainly by electric and by cable-power. The capital invested in these roads was yYha.e gP oP d.uin 'rdlurdra sons were employed on them. In 1894 the total mileage was 12,527, of which 7,470 was electric. The capital invested was $648,330,755, of which $423,493,219 were invested in electric railways. One hundred and ten thousand persons were employed on street railways in that year. In 1896 the mileage had increased to 14,470, of which 12,133 miles were electric. The capital invested was $784,813,781, and the number of persons employed was not less than 140,000. The total mileage of electric railways in the United States up to October of 1897 was 13,765 miles, out of a total mileage of 15,718, and of these but 947 miles were horse-car lines. The total capital invested was $846,131,691, and the number of employees may be safely estimated at not less than 166,000.—From Cassier's Magazine.

EDUCATIONAL.

UNIVERSITY OF MINNESOTA NOTES.

Among the recent non-resident lecturers before the College of Engineering of the University of Minnesota are two well-known electrical engineers.

On January 24, Mr. J. J. Carty, chief engineer of the New York Telephone Company, gave a lecture on "Telephone Disturbances." The sources of the disturbances upon telephone lines were discussed in an able and intensely interesting manner, with the help of numerous diagrams. Special attention was given to the problems presented by the increasing use of high tension, alternating currents for power transmission, and their effects upon telephone circuits, illustrations being drawn from experience of telephone lines in Minneapolis and St. Paul, with the 3,750 volt and the 12,000 volt three-phase circuits of the Twin City Rapid Transit Company, and those of the Minneapolis Central Electric Company.

On January 26, Mr. Truman Hibbard, general manager of the Willow River Electric Light and Power Company, of Hudson, Wis., lectured upon "Hydro-Electric Power Plants," discussing certain features of three-phase and monocyclic systems for transmission and distribution purposes. Mr. Hibbard gave an interesting account of the power plants under his charge, showing the great flexibility of electrical apparatus. In two cases the power plant is reinforced by 600-volt direct current motors, driven by generators at other water falls not far distant. In one case the distant wheel and generator, being controlled from the principal station. A novel arrangement of secondaries was described, showing how a monocyclic generator may be used in emergency to supply three-phase circuits from the regular transformers.

The electrical engineering museum has recently been enriched by a number of pieces of station auxiliary apparatus, secured from the Minneapolis General Electric Company, showing various steps in the development of lightning arresters and switchboard apparatus.

A Heisler two-phase alternator, recently secured from the Mankato Electric Light and Gas Company, is being modified for experimental use, a system of switches being arranged to permit the easy and rapid changing from 1,000 volts to 100 volts at will, also enabling the use of both pressures at the same time.

San Paulo, Brazil.—The San Paulo Gas Co. has decided to at once erect an electric light plant for the supply of current for lighting and power. They have already entered into an agreement to light the new railway stations in course of erection in San Paulo. The gas company has decided upon this, because of the strong position they occupy in San Paulo with the new concession for thirty years, and, being in position to raise the capital without difficulty. The company's consulting engineer has been instructed to prepare the plans and specifications and obtain tenders for carrying out the work with the least possible delay.

The Crehore-Squire Co., of Cleveland, O., has been incorporated with a capital stock of $1,000,000, to conduct a telegraph business. The promoters of the new company will adopt the system invented by Messrs. Crehore and Squire, which, they say, will revolutionize telegraphy. Among the incorporators of the company is Harry A. Garfield, eldest son of the late President Garfield.

AMONG THE SOCIETIES.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.

A meeting of the Executive Committee of the Fire and Police Telegraph Superintendents' Association was held in Boston on Saturday, Jan. 28, at the offices of the Wire Department. The object of the meeting was to revise and amend the constitution and by-laws, in accordance with the resolution passed at the third annual convention, at Elmira, and to outline the arrangements for the next annual meeting, which takes place at Wilmington, Del., September 3-6; also to suggest topics for papers to be presented at that meeting.

In order to broaden the field of work in which the association is engaged, it was decided to change the name from the "International Association of Fire and Police Telegraph Superintendents" to the "National Association of Municipal Electricians," which title renders eligible for membership all officials engaged in the electrical departments of municipalities throughout America, instead of only those engaged in the fire and police telegraph departments, as heretofore.

Papers that will be read at the next annual convention:

"The Laws and Government of the Wire Department of Boston," by Commissioner Thomas W. Flood.

"Licensing of Employees Engaged in Electrical Work and the Improvement of the Quality of Work and Material," Captain William Brophy.

"Advisability of Concentrating the Control of all Municipal Electrical Interests Under One Head," Morris W. Mead.

"The Underground Systems, as Applied to the Fire Alarm Telegraph," S. L. Wheeler.

"Aerial Construction of Fire and Police Telegraph Lines," W. H. Thompson.

"The Police Signal System of Boston," John Weigel.

"Progress and Development of the Municipal Electrical Interests of Canada," G. F. MacDonald.

In connection with the next meeting of the association will be held an exhibition of electrical and machanical apparatus, used in various departments of municipal work. A large building, well adapted for this purpose, has been secured, and every facility will be afforded manufacturers to attractively display their goods. Ample power will be supplied for operative exhibits, and a special commit-

tee will be appointed by the association to make report on the exhibits.

The railroads have agreed to make special freight rate to exhibitors.

After the work of the Executive Committee was completed, a visit was made to the works of the Gamewell Fire Alarm Telegraph Co., at Newton Upper Falls, under the guidance of Mr. W. E. Decrow, the representative of the Gamewell Co. in Boston.

Upon returning to the city, the party was conducted through the magnificent new terminal station by Captain John Sanborn, the general manager; G. B. Francis, the resident engineer; Treasurer Coon, and Electrician Caldwell..

Captain B.S. Flanders, superintendent of fire telegraph, and Mr. John Weigel, superintendent police telegraph, conducted the visitors through their respective departments, and the party then adjourned to The Hayward, where a most agreeable surprise, in the form of an elaborate banquet, awaited them.

The following are the names of those who attended the meeting and subsequent entertainments: William Bro-p[illegible], F. C. Mason, Morris W. Mead, C. W. Price, Walter O. Faulkner, B. S. Flanders, F. M. Ferrin, Thomas W. Flood, John Weigel, H. F. Cottle, W. E. Decrow, S. L. Wheeler, Clarence E. Stump, John W. Aydon, W. Y. Ellett, W. H. Thompson, J. S. Wilson, C. O. Baker.

NEW YORK ELECTRICAL SOCIETY.

By courtesy of the Electrical Vehicle Co., the Society's 194th meeting will be held at its station, 1684 Broadway, on Tuesday, February 14, at 8 p. m.

Mr. G. Herbert Condict, the electrical engineer of the company, will give an informal talk on the status of the automobile, and the impending enormous development in its use.

After Mr. Condict's remarks, the Society will be escorted in groups over the building. Each group will be in charge of an attendant, who will describe the various departments visited Ladies will be admitted.

A large attendance is expected and it has been found absolutely necessary, both for the convenience of the Electric Vehicle Co., and the success of the general arrangements, not only to know as early as possible the number of intending visitors, but to limit the admission to the building strictly to members of the Society and their friends. To this end the co-operation of the members in the folllowing arrangement is earnestly requested:

Each member proposing to be present will inform the secretary not later than Saturday, 11th, of his intention, saying whether or not he will be accompanied by a lady. On receipt of this information, a special ticket of admission will be forwarded to the applicant and except by such special ticket no one will be admitted to the building. Collation.

BUSINESS NEWS.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING JANUARY 31ST, 1899, $68,145.00.

New York, N. Y., Jan. 31, 1899.—The following exports of Electrical Material and Machinery are from the port of New York for the week ending this date:

Argentine Republic.—Thirty-seven cases electrical material, $1,668; 14 cases electrical machinery, $1,238.

Azores.—One case electros, $1.

Africa.—Two packages electrical material, $551.

Antwerp.—Twenty-two packages electrical material, $1,935; 33 packages electrical machinery, $12,351.

British Possessions in Africa.—Fourteen cases electrical material, $2,328; 26 packages electrical machinery, $7,674.

British West Indies.—Thirty-two packages electrical material, $347.

Brazil.—One hundred and eighty-seven packages electrical material, $4,022; 45 packages electrical machinery, $1,630.

Cuba.—Sixty-seven packages electrical material, $2,286; 2 cases electrical machinery, $122.

Chili.—Twenty-three packages electrical material, $1,200; 6 packages electrical material, $132.

Dublin.—Fifty-five cases electrical material, $9,256; 3 cases electrical machinery, $3,432; 2 cases electro plates, $300.

Central America.—Five cases electrical machinery, $286.

Glasgow.—One hundred and three packages electrical machinery, $3,367.

Havre.—Seven packages electrical material, $362; 1 package electros, $25.

London.—Forty-two packages of electrical material, $2,205; 137 cases electrical machinery, $8,445; 32 cases electrical machinery, $252.

Liverpool.—One case electrical material, $50.

Naples.—Two cases electrical material, $275.

Oporto.—Twelve cases electrical material, $538.

Peru.—Sixty cases electrical material, $546.

Southampton.—Thirteen packages electrical material, $486.

United States of Colombia.—Two cases electrical machinery, $100.

Venezuela.—Two hundred packages electrical material, $725.

NEW INCORPORATIONS.

Jersey City, N. J.—The J. Jones & Son Co., incorporated by John Jones, James Jones, Jr., and John R. Everett, general electric manufacturing and trading business. Capital stock, $100,000.

Hartford, Conn.—The Trumbull Electrical Co. has been incorporated by W. S Ingram, H. Trumbull, and J. H. Trumbull; electrical appliances. Capital stock, $2,000.

Jersey City, N. J.—Columbia Electric Car Lighting and Brake Co. has been incorporated by Edgar W. Youmans, Robert B. Upham, and Kenneth K. McLaren; to manufacture, etc., gas and electricity and machinery used therefor. Capital stock, $2,000.

East Orange, N. J.—Auto-Electric Co., has been incorporated by Timothy M. Cheeseman, Garrisons, N. Y.; Nelson Hiss, and Duncan T. McLaren. Capital stock, $1,000,000.

Newark, N. J.—Economic Light and Power Co., incorporated by Horace M. Decker, Richmond C. Coventry and Frederick M. Payne; electricians, mechanical engineers, to manufacture electricity for light and power. Capital stock, $100,000.

Newark, N. J.—Middlesex Electric Co., incorporated by Manning Freeman, John M. Connor, Herbert C. Richardson, Willard S. Muchmore, and Frederick G. Agens, Jr., to manufacture electricity. Capital stock, $100,000.

Weymouth, Iowa.—Weymouth Meter Power Co., incorporated with a capital stock of $30,000; water and electric power.

New York, N. Y.—The Massena Electric Light and Power Co., incorporated by Thomas H. Gillespie, R. A. Johnston, and others. Capital stock, $10,000.

Waterloo, Iowa.—Citizens' Heat, Light and Power Co., incorporated by G. W. Dawson, J. D. Easton, G. E. Lichty and others. Capital stock, $100,000.

Franklin, Ky.—The Franklin Electric Light Co., incorporated by Benjamin F. Gardner, W. H. Isbell, and J. E. Potter; for the erection of an electric light plant. Capital stock, $15,000.

POSSIBLE INSTALLATIONS.

Rome, Ga.—D. B. Hamilton, Jr., and others are interested in the proposed construction of an electric light plant.

Lafayette, Ala.—The Mayor may be addressed concerning construction of electric light plant.

Springfield, Tenn.—H. E. Butcher has commenced work on the erection of his new electric light plant, which will be in operation by May 1.

FLASHES.

Red Bluff, Cal.—The Tehama Electric Co., plant destroyed by fire at a loss of $20,000 or $30,000.

TELEPHONE CALLS.

Little Valley, N. Y.—The Little Valley Telephone Co., has been incorporated by S. W. Bedient, S. S. Bedient, F. G. Barnes, W. C. Parker, H. J. Crissey, and M. J. Rich; to operate a telephone system in Cattaraugus Co. Capital stock, $500.

Benton Harbor, Mich.—The Twin City Telephone Co., has increased its capital stock from $25,000 to $50,000.

Boynton, Fla.—The Florida, East Coast Telephone Co., incorporated by Maj. N. S. Boynton, President; G. M. King, vice-president; P. M. Loud, Jr., secretary, and M. B. Lyman, treasurer; for the construction of a telephone system. Capital stock, $10,000.

Winchester, Ky.—The Winchester, Ford & Richmond Telephone Co., incorporated by S. T. Prewitt, David Prewitt and D. L. Pendleton; to construct a telephone system from Winchester to Richmond. Capital stock, $600.

Red Sulphur Springs, W. Va.—The Red Sulphur Springs, Peterstown and Union Telephone Co. has been incorporated by W. H. Ballard, C. M. Spangler, J. E. Hansberger, R. F. Fleishman, and J. A. Meadows. Capital stock, $5,000.

Cameron, Mo.—The Cameron Telephone Co.. has been incoporated by E. C. Baker, S. D. Thompson, J. A. Livingston, C. F. Thompson, J. M. Thompson, and M. J. Baker. Capital stock, $10,000.

Trenton, Mo.—Trenton Telephone Co. has been incorporated by P. W. Bain, W. W. Bain, C. J. Bain, J. B. Wright, A. U. Spickhard, B. C. Nichols and E. M. Harber Capital stock, $8,000.

New York, N. Y.—The Fahnestock Transmitter Co., has been incorporated by G. O. Robbins, E. B. Fahnestock, N. Chase, J. E. Cheeseman, and W. S. Logan; electrical transmitters. Capital stock, $100,000.

STREET RAILWAY NEWS.

Pottsville, Pa.—The Schuylkill Electric Railway system is to be extended.

New York, N. Y.—The Massena Electric Street Railway Co., incorporated by Thomas H. Gillespie and others. Capital stock, $100,000.

Detroit, Mich.—Grand Rapids & Kalamazoo Railway Co., incorporated by W. W. Hannan, James Gamble, C. W. Taylor, and Arthur D. Prosser; electric railway. Capital stock, $100,000.

BUSINESS CHANGES.

Chicago, Ill.—The Chicago Electric Traction Co. has filed a mortgage for $500,000.

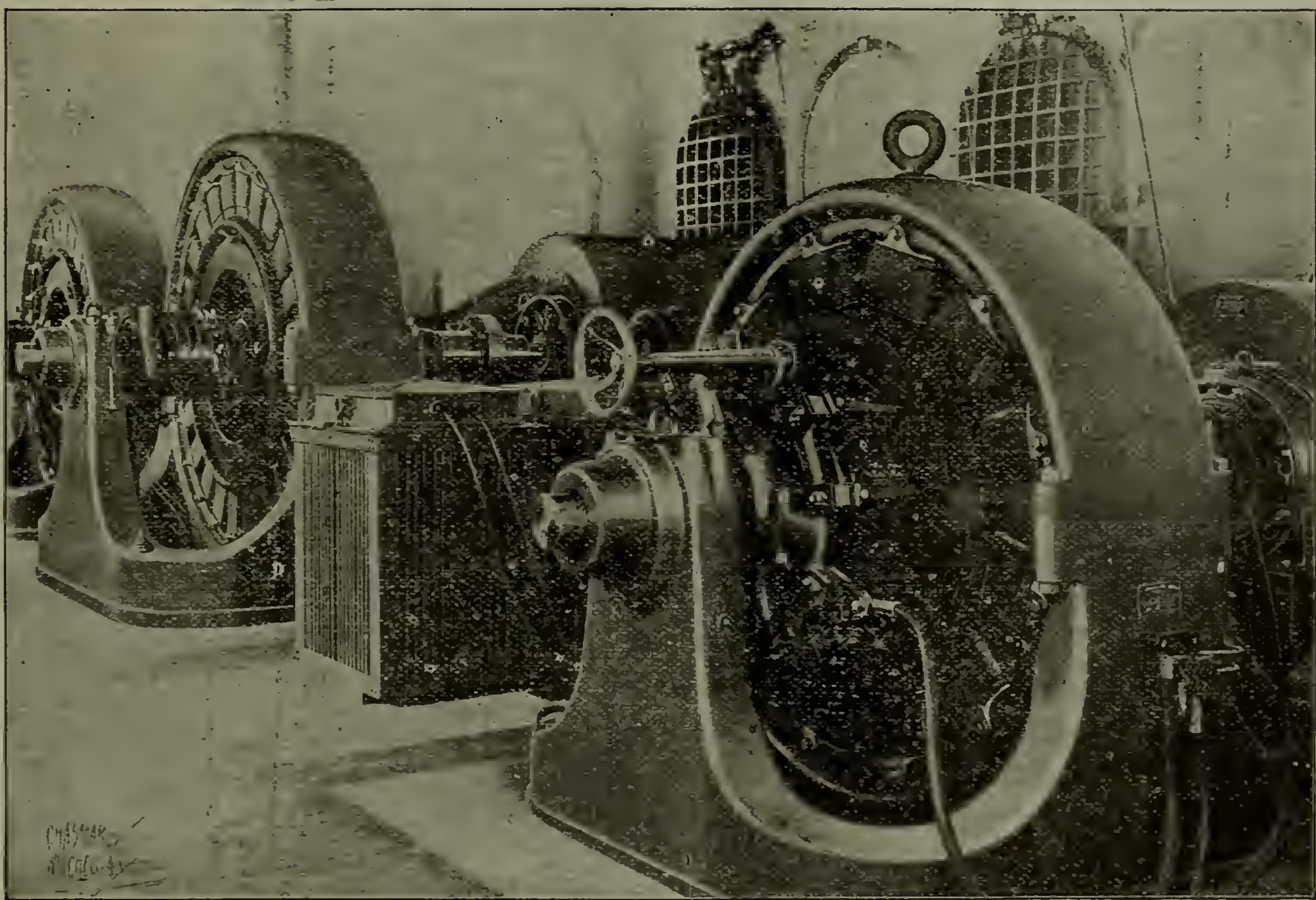
Fort Wayne, Ind.—The Fort Wayne Electric Corporation; petition filed asking that company be declared bankrupt.

New York, N. Y.—The Electrical Company of America has absorbed the Jamaica Electric Light and Power Co. The capital stock of the Jamaica Co. is $1,500,000.

The Electrical Age.

Vol. XXIII—No. 7 NEW YORK, FEBRUARY 18, 1899 Whole No. 614

LIGHTING.



Generators in the Fowler Bros. Electric Light Plant, at Cienfuegos, Cuba.

ELECTRIC LIGHTING IN CUBA.

The influence of American capital on Cuban territory has already been felt to such an extent that several large electrical enterprises are approaching a happy completion. The main roads or turnpikes of Cuba during stormy weather become almost impassable. The various coast cities in Cuba are lit in the most primitive manner at night. The telegraph and telephone systems have received little or no attention, and, in fact, it may be said that even in their modes of life the present occupants of Cuba belong to an era that with us has long since been outlived.

The Spanish greed for gold made it almost impossible for foreigners, even Americans, to start a new enterprise in Cuba without paying a large bonanza to the Cuban authorities. In consequence of this rapacity one of the richest and most beautiful countries in the world, full of mineral wealth and capable of great commercial development lay idle and untouched for several centuries. Many sugar planters and some few other manufacturers impressed with the spirit of improvement imported some electric light machinery, using the current for lighting and on some few occasions for power purposes.

A characteristic group is shown in the illustration, including several who constituted the engineers of the body, taken under the burning sun of the tropics. The plant that has been erected there, which might have been better called the Cuban Electric Light and Power Co., on account of the difficulty in pronouncing its name, consists of two altemators and one multipolar generator built by the General Electric Co. The power from this plant will be conducted along poles to the city and to some adjacent plantation. One of the largest plantations using current from this source is that of Fowler Brothers, chief stockholders.

It is proposed to extend the line, if possible, and run a trolley system through several small villages on the out-

skirts of Cienfuegos, near which the plant has been installed. During the late war the building of this power house was interfered with although plans had been drawn up and preparations made. Fowler Brothers, two college men, brought up in the United States, have employed the best skill in the neighborhood afforded. Mr. O. P. Loomis, the well-known electrical engineer, at one time connected with the Eureka Electric Co., drew up the plans and specifications, which have been followed out in detail by the contractors.

During the rainy season the terrific electrical discharges cause so much damage that it was deemed necessary to employ the very best of lightning arresters and lightning rods. Should traffic along the road improve the trolley line will be erected and a generator installed to supply power. The slow going teams are a much greater source of expense, considering both time and labor, than an electric car. There is a possibility also that the employment of this method of traction will help to civilize and increase the number of city and suburban residents.

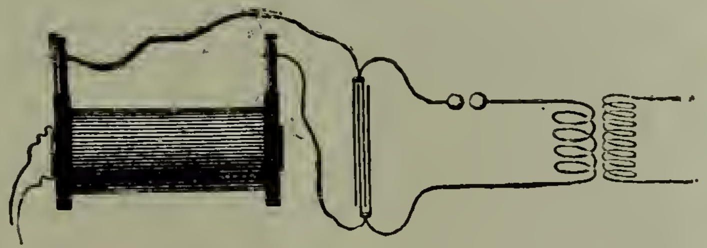
Employees of the Cienfuegos (Cuba) Electric Light Plant.

ARTIFICIAL DAY LIGHT BY HIGH AND LOW FREQUENCY CURRENTS.

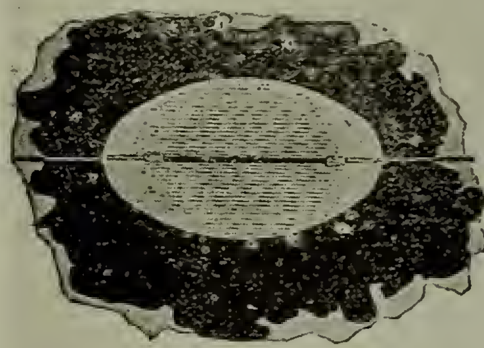
Simple Geissler tube experiments produce radiant energy in a limited quantity. The step forward is the use of vacuum tubes in which light may be produced in sufficient quantities to be commercially applied. The high pressures and high frequencies now in vogue have greatly modified the apparent risk and danger connected with the development of light by this method. It is reasonable to suppose that vacuum tube lighting will become as universal in the course of time as incandescent or arc lighting is at present. While this light may be called "artificial day light" it is not more so than any of the other forms of light with which we are familiar. Nature has produced and is producing a form of radiant energy, which may be called "physiological light," which possesses some curious properties. "A spectro-photometric analysis of the light proceeding from the Pyrophorus, taking the wave lengths for abscissae and the intensities of the luminous rays for ordinates, shows that the area between the axis of the wave length and the curve is in the light from this insect, almost wholly occupied by green and yellow rays. As far as the wave length is concerned, it is precisely the same which affords the maximum of clearness in the solar spectrum. The light of the Pyrophorus can be estimated. It would take from thirty-seven to thirty-eight of them, all luminous at once, to light up an apartment with the same intensity as a candle." An authority remarks as follows: "The quantity of heat generated by the photogenic organ is infinitesimal, and the most sensitive instruments fail to show any electrical phenomena whatsoever, accompanying the production of light. In addition, it may be stated, that in contrast with artificial light, in which 98 per cent. of the energy is employed otherwise than in producing illuminating rays, "physiological light" employs effectively 98 per cent. of energy with only 2 per cent. loss." The lack of similarity between methods of producing light, comparing nature and ourselves, is so striking that we are led to believe and hope for progress in more ideal systems of vacuum tube light lighting Nikola Tesla, MacFarlane Moore, J. H. J. Haines have made considerable progress in this interesting field of work. As far as the first is concerned, the combinations effected with self induction and capacity are the means of producing high frequency currents, which offer a possible solution to the vacuum tube problem. On the other hand, the breaking of a circuit automatically, the self induction of which creates a glow within a tube, represents the special field occupied by Moore. But the third system, employed by Haines, is one in which the ordinary alternating current is employed, and produces its light in vacuum tubes without the aid of any special contrivances

that one would be led to expect. As far as the theory of vacuum tube lighting goes, it is presumed that high pressure and high frequency are essential if white light is to be produced. Consequently the efforts of experimenters have been directed towards the solution of this problem along these lines. It does not necessarily follow that because electric lighting is being done at present that

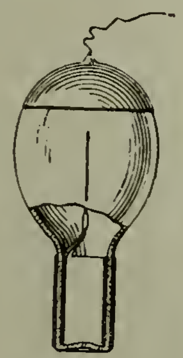
Therefore, an electro-magnetic means may be employed whereby waves of small length aroused in the ether will give the sensation of light. In the illustrations, various methods of producing light and high pressures are shown, including those adopted by Tesla. Prof. Raphael Du Bois, professor of general and comparative physiology in the faculty of sciences at Lyons, speaking of the Pyrophorus



Manner of Operating an Induction Coil.



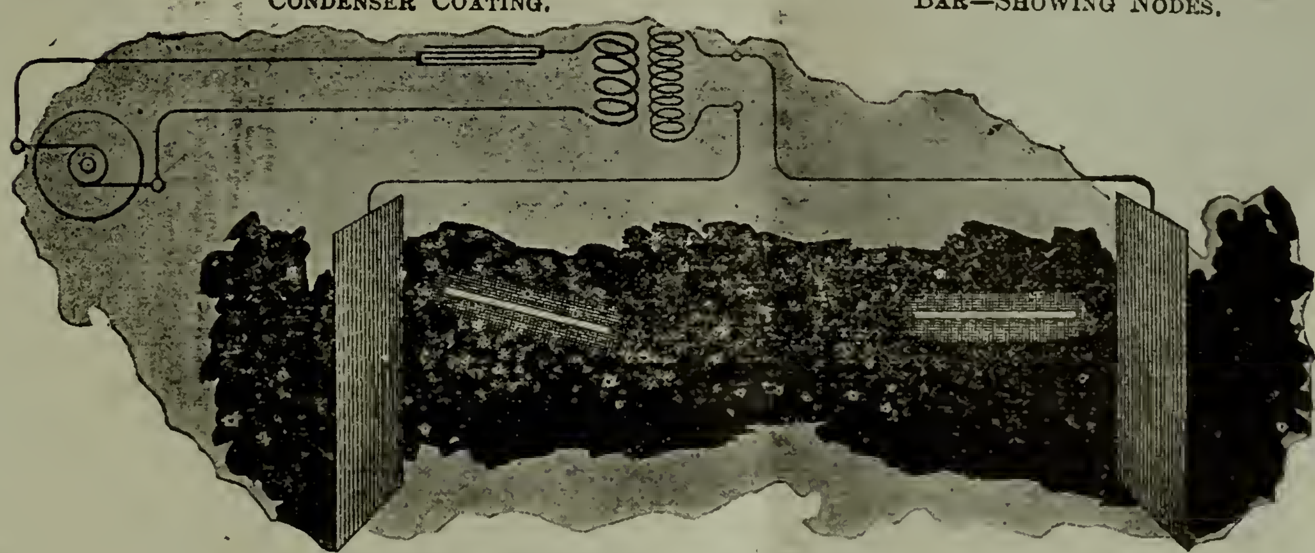
Phenomenon of Impedance in an Incandescent Lamp.



Lamp with One Filament, One Inside and One Outside Condenser Coating, and Auxiliary Coating.

Lamp Kept at Incandescence across a Thick Copper Bar—Showing Nodes.

Lamp with One Filament, One Inside and One Outside Condenser Coating.



Ideal Method of Lighting a Room.—Tubes Devoid of Any Electrodes Rendered Brilliant in an Alternating Electrostatic Field.

a purely electrical means of illumination will be finally adopted. Neither should we believe that because the Pyrophorus by some chemico-physiological process gives issue to light that of a certainty this plan is the only desirable one. Artificial day light emanating from tubes or from a device exposed to the influence of an alternating electro magnetic stress fulfills the theory of Maxwell that light itself is an electro-magnetic phenomenon.

in his experiment states: "Was I not right when I said, in the first place, that this 'physiological light' ought by its composition to serve as a type for the artificial light of the future, and have not the recent applications of zirconium to illumination already partly shown the accuracy of my prediction? Up to 1886, when I published my first researches nothing was thought of but the perfecting of the illuminating apparatus then in use. I believe

that I opened a new and promising field for future progress by showing the inferiority of these means, when compared with those of nature, and by placing the question upon the ground of producing illumination by a new method."

MISCELLANEOUS SCIENCE.

STRAY CURRENTS.

ELECTRICAL COLLECTORS.

On January 21 W. A. Eddy, of Bayonne, N. J., sent up an electrical collector to a great height by means of four kites, each 7 feet in height. The collector had four 6-inch cardboard points covered with tin foil. Thin bare copper wire ran down the kite cord and into Eddy's house. The sparks which were obtained were much smaller than Eddy had expected from a collector raised to such an elevation.—Ex.

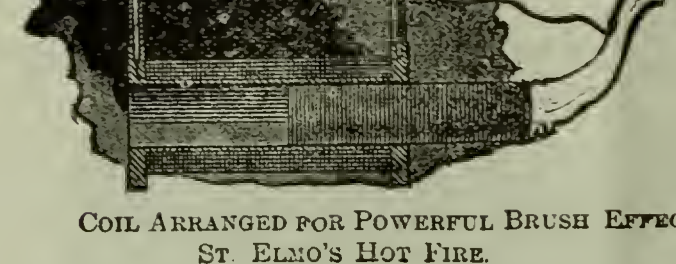
—Lamp with Single Block of Refractory Material

THE FRENCH WESTINGHOUSE COMPANY.

The Westinghouse Electrical & Manufacturing Co. has just received word that the newly organized French Westinghouse Co. has obtained the contract for the equipment of the Paris Metropolitan Railway with the underground trolley. Several German and American concerns were competitors for the contract. The apparatus will be made at the company's works at Havre.—Ex.

THE ELECTRIC ARC.

The lighting up of the electric arc is not instantaneous. It begins at the positive carbon about one thousandth of a second before it starts at the negative carbon. The lighted areas then travel until they meet one another, unless the distance between the carbons is less than half an inch. In that case the light from the positive, which travels at the rate of 500 inches per second, gets across before that from the negative pole starts. The light from the negative pole goes 300 miles per second.—Ex.



Coil Arranged for Powerful Brush Effects.—St. Elmo's Hot Fire.

ELECTRIC POWER AT A FRENCH COLLIERY.

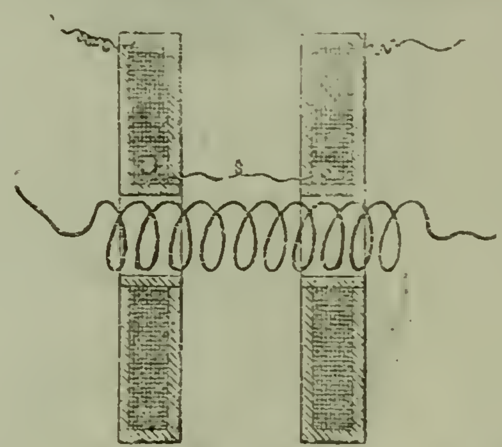
At the January meeting of the Saint-Etienne Section of the Societe de l'Industrie Minerale, M. Desvignes, Ingenieur-Directeur of the Mine du Cros, gave some particulars of the electric plant put up at that colliery. The triphase current, adopted on account of the slighter giving out of sparks, as regards possible fire damp disengagements, is generated at the mouth of the Camille shaft, and will drive an underground hauling engine and also a pump, respectively 640 and 900 m. distant, while eventually other plant, especially a large fan, will be driven by the current.—Ex.

POWER TRANSMISSIBLE.

Electric power has been transmitted 108 miles with 70 per cent. of efficiency. Much more is possible, and Professor George Forbes, speaking in London the other day, expressed the opinion that the power of the Victoria Falls on the Zambesi might be economically carried 500 miles for the development of mining in Rhodesia. He had considered plans in New Zealand and India for transmitting power 250 miles, miners in some cases being prepared to pay 500 dols. and even 900 dols. per annum for each horse power. Many other industries might be benefitted by tapping distant sources of power, such as irrigation in Egypt, and he has found that the electric lighting of Cairo could be done cheaper by power generated 400 miles away, at the First Cataract, than by steam engines in that city. In all cases the serious outlay is for copper.—Ex.

ACTION OF ELECTRICITY UPON PLANTS.

The fascinating subject of the action of electricity on plants attracted De Candolle as long ago as 1806, and recent electricians and botanists have given it much attention. Results have been variable. In experiments since 1886, Dr. E. H. Cook reports that constant and intermittent currents of high and low tension have had the general effect of increasing the development of seeds from 10 to 20 per cent., but that plant growth after germination has seemed to be little affected by low tension currents. Wih an electro-motive force of 25 to 40,000 volts, the increase in growth has been considerable and rapid. On a large scale various experimenters have tried sinking in their gardens plates of copper and zinc, and plates connected with a battery, but the most remarkable results seem to have been achieved with the "Geomagnetifere," from atmospheric electricity. This apparatus is simply a lightning conductor set up in the middle of the field and connected below with a series of cross wires running under the soil near the roots of the plants. In France such a conductor 25 ft. high was found to exert an influence over a radius of more than 20 yards, and a plot of ground within the area yielded 53 kilograms of potatoes against 35 kilograms from an exactly similar plot outside.



—Coil for Producing Very High Difference of Potential.

The Electrical Age.

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TRACTION AND WEIGHT.

Some of our street railway companies have been experiencing considerable difficulty of late due to the fact that the tractive power of the car and weight have not been duly proportioned. The problem of traction, particularly that of electrical traction, is one involving three elements, which, unless properly considered, will bring about discouraging results in the system.

These three are, the weight and power of the car and the width of the track. The grip the wheels make upon the track depends largely upon its size and shape, the amount of friction between them, upon the weight of the car, body and truck. In wet or slippery weather a phenomenon occurs which is frequently noticed at steam railway termini, that is to say, the slipping of the wheels on the track.

In order to make rapid headway, in fact, in order to arrive in time the motormen are obliged to run at full speed almost all the time. The quick starting of the car is absolutely necessary, but the difficulty of doing this is perfectly obvious to those travelling on electric cars in stormy weather when snow or sleet covers the track. To obviate this difficulty it would not be wise to add weight to the cars themselves but the use of broader rails and wider car rails would certainly increase the pull within a given time from 20 to 50 per cent. The great problem that presents itself to the Manhattan Elevated Railroad is that of gaining sufficient acceleration to gain time between stations. Of course reference is made entirely to the use of electricity, which seems in some way to require careful consideration before being applied when this object is kept in view.

Acceleration tests show that the watt consumption at the start and for about ten or fifteen seconds is enormous in comparison with the equivalent in foot pounds absorbed by a locomotive. This discrepancy is one which may be investigated from the standpoints of steam expansion and current consumption.

If a ten-horse power locomotive, for instance, wou'd accelerate a train of cars to a given speed within a time given, it appears as though a fifteen or twenty-horse power motor would be required to produce the same acceleration over the same road in the same time. Elevated roads or steam roads that stop at way stations within a short distance within each other consequently might be at a disadvantage with a motor of the same horse power as their locomotive although it is quite clearly understood that heavy as well as light electric railroading is a greater success, considering the time of experiment, than even that of steam.

A steam locomotive possesses about 14 per cent. efficiency. By producing power in a station at about 14 per cent. efficiency and utilizing it in the motor at from 5 to 8 per cent. efficiency the advantage of using electric power is quite obvious. The total consumption of the elevated roads in this city would be greatly reduced if such fuel were burned in one large station. But it must be remembered that in the operation of steam or electric roads the expense of fuel is a small one in comparison with other items, the most important of which in the eyes of the general public is that of quick transit and short stops.

In this sense the engineering art is moulded to suit the decree of the general public whose matter of fact demands in large cities have made inmpossibilities possible. The municipal restrictions in New York do not allow of the erection of overhead lines of any description. The closed conduit system was not in a state of development that admitted of application, and the open conduit system, which had been "tabooed" by engineers as full of most serious difficulties by pure force of circumstances reached the front rank, has been installed, is a money maker and is successfully operated.

The Metropolitan Traction Company of this city, will have a perfect monopoly of the trade if their cars will travel through storms. Certain deficiencies in the open conduit system are not due to difficulties in construction but depend largely upon climatic conditions and upon the common sense of the man at the controller. During the last blizzard the man at the T rails within the conduit became coated with ice. The conduit itself was filled with snow and the sewer connections that drain the conduit were perfectly useless.

At least two days elapsed before the roads could be operated, which meant a loss to the Metropolitan Traction Company of possibly $50000. This will be lost more than once if during storms they cease running, but we believe that part of this money spent for the opinion of an able engineer might pay an everlasting dividend to stockholders and save not only the expense incurred by the stoppage but the criticism which some of the daily papers feel forced to make.

The Electrozone Commercial Co., of Philadelphia, will, it is stated, erect a plant at Atlantic City with a capacity of 10,000 gallons a day.

PRODUCTS OF THE ELECTRIC FURNACE.

THE COST OF MANUFACTURE OF CALCIC CARBIDE.

(Extract from Cantor Lecture, by Prof. Vivian B Lewes.)

In the manufacture of calcic carbide in the electric furnace lime and hard metallurgical coke of the highest possible degree of purity are employed. A good working mixture of these materials may be taken as being 100 parts by weight of lime with 68 parts by weight of carbonaceous material; and about 1.8 pound of this is used up for each pound of carbide produced. It must not be forgotten in computing the cost of carbide that lime of sufficient purity for the purpose is not only costly, but difficult to obtain in large quantities.

It is found that as the ingot of calcic carbide is formed in the furnace, although the ingot itself consists of pure crystalline calcic carbide, it is nearly always surrounded by a crust in which the carbide contains a certain proportion of imperfectly converted constituents. This gives a lower yield of acetylene than the carbide itself; and in breaking up and sending out the carbide for commercial work, packed in air-tight drums, the worst of the crust is, as far as possible, picked out and rejected. It is perhaps misleading to state the amount made per electric horsepower, as a certain amount of loss is, of necessity, entailed during the breaking and packing. For instance, in practical working, I have found that whilst the furnace return was 0.504 pound per kilowatt-hour, this amount has been brought down to 0.406 pound per kilowatt-hour when the material has been broken up, sorted, and packed in air-tight drums. It will be sufficient for practical purposes to state that the cost of the material, labor, and wear and tear of plant, independent of the power used in the electric furnace, but inclusive of packing, for making a ton of packed carbide will amount to from £3 to £4, according to locality, which, of course, entirely governs the cost of the material used; whilst the cost of the electrical horse-power necessary for the conversion of the material will entirely depend on whether it is obtained from steam, gas engines, or water power, the latter, where obtainable, being the cheapest, and in this country costing nearly £4 per electrical horse-power per year.

ELECTRIC MOTORS.

PRACTICAL APPLICATION OF THE ELECTRIC MOTOR TO PRINTING PRESS MACHINERY.

(Read before the Electrical Section of the Franklin Institute.)

During the past five years the electric transmission of power has made most rapid strides. Aside from long distance transmission and railroad work, we can safely say that the individual motor application to machinery stands in the first ranks.

There are no statistics giving the aggregate horse-power now used for this purpose, yet it is safe to assert that no one branch of machinery can show the results in power saved, improved product and increased output from the application of the electric motor as printing machinery.

The printer demands that all the good features of the belt drive as to power and convenience of handling be retained when the individual electric motor is substituted for belt power.

That nothing be sacrificed in economy of operation and completeness of outfit, it is necessary that care be exercised in the selection of the type of motor, method of control and attachment.

If this is to be done, the first step consists in becoming familiar with printing press work, studying closely the mechanical features of the press to be equipped; then, and not until then, are we ready to take up the electrical end.

Of the series, shunt and compound motors, the latter gives the most satisfactory results.

Belted, geared and direct connected motors can be used, though only geared and direct are distinctly advantageous over belting from main line shafting. The selection as to which is better must be decided in each individual case. Control of press must be positive as to handling under all conditions and providing a suitable range of speed. Where possible, arrange presses to operate at a uniform rate of speed, doing away with the demand for wide extremes, which are rarely used.

Of the various methods of control for direct motors, a combination of armature and field control is best. Armature control with carefully proportioned gearing, in sizes up to 5 horsepower, is a dangerous rival of direct motors. All individual motors should be so attached to frame of press as to be practically part of it; separate motor foundations are a failure. Geared motors should be supplied with rawhide pinions having brass sleeves and sides, always using single reduction. Ratios of 10 to 1 are permissible where press speed is not over 120 R. P. M.; 5 and 3 to 1 where speed is 175 R. P. M., and upwards.

Direct motors should be used where noise is an objection, as well as on all large presses, especially for newspaper work.

Each equipment should be provided with an automatic circuit-breaker, one that will protect press while looking after the motor. This is an absolute necessity if we obtain all the advantages of the individual drive.

Cost of direct versus geared press equipment, for new presses, is 25 to 33 1-3 per cent. more for the former. Where old belted presses are to be changed with conditions equal, the cost is about the same; the gearing with fixtures amounting to difference in cost between motors. This applies to 5 horse-power motors and larger; smaller sizes may cost very much more, sometimes double.

General advantages secured by substituting individual electric drive for belting are economy of power, positive speed applied direct to main driving shaft of press, ability to locate press without reference to main line of shafting, freedom from dust and dirt, higher grade work and increased output, which should amount to 15 per cent. without extra wear on machinery. This will easily pay for the electric equipment within three to five years.

As a reliable method of power application, the electric motor is without an equal, for when properly designed as to its work, supplemented with substantial attachment, the repairs are practically nil.

With flat bed presses, printing 32 pages 16mo. per impression, an average product can be secured, including all allowance for "make ready" and handling paper, of 21,000 pages per kilowatt-hour, with price 5 cents per kilowatt hour, 4,200 pages can be printed for 1 cent.

Wet presses doing same class, size and grade of book work, will print, cut and fold 91,000 pages per kilowatt-hour, taking same price, 18,000 pages are printed for 1 cent. A comparison shows a balance of 4½ times in favor of the wet presses.

When large number of presses are in use, a safe ratio of 5½ to 1 can be as horse-power in motors to horse-power in generators installed.

TELEPHONIC.

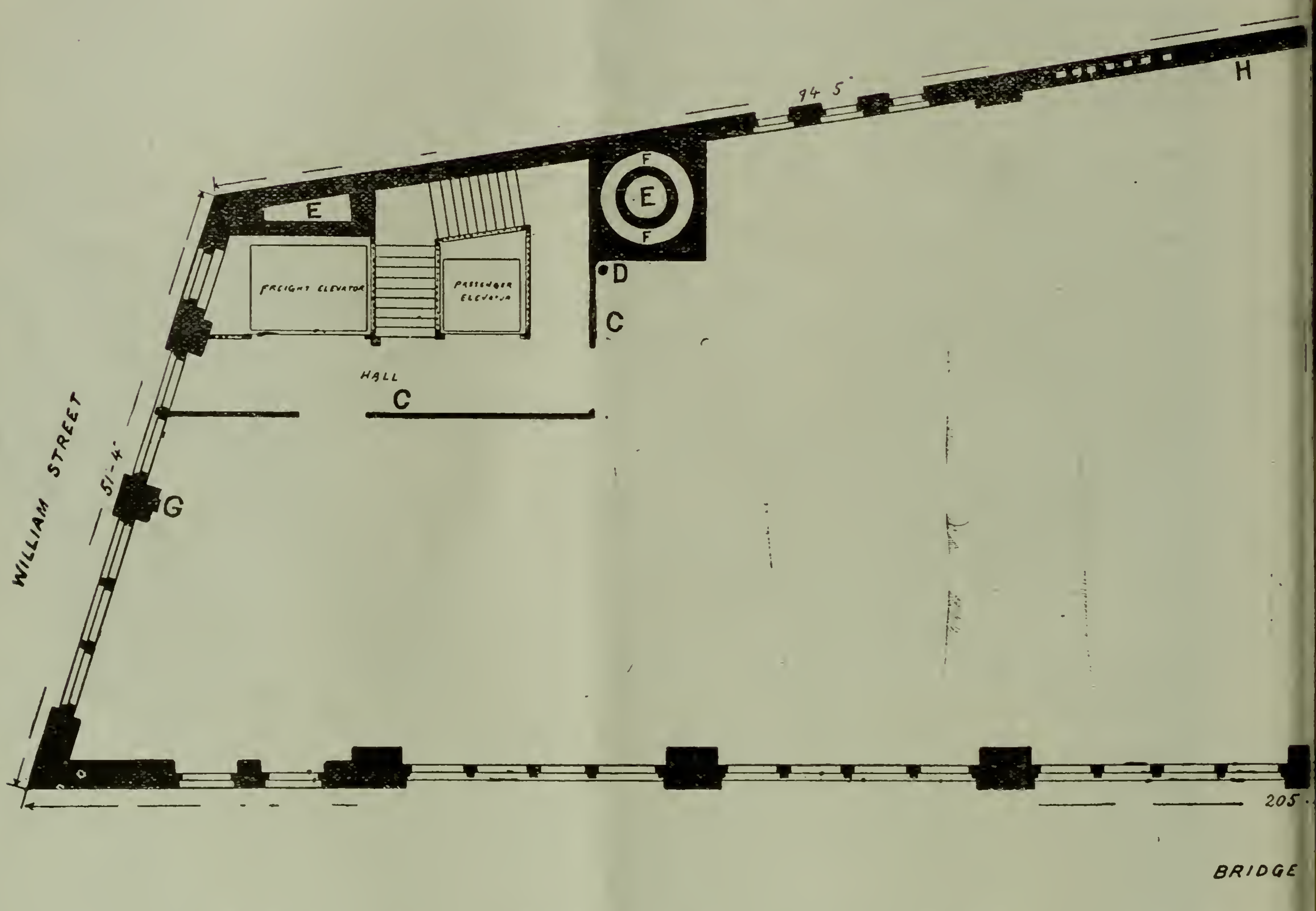
TELEPHONE INVESTIGATION.

Assemblyman Frederick Schmid, of Kings County, introduced a resolution in the New York State Assembly, that a committee of seven members of the Assembly be appointed by the Speaker to examine into and ascertain the receipts and expenditures of the Bell Telephone Company and the amount of capital invested and dividends paid for the period of the existence of the company so as to enable the Legislature to judge what would be proper and reasonable rates for telephone charges by the company. It was referred to the Ways and Means Committee.

In a voltaic cell there is about one and one-twentieth ounce of zinc consumed for every ounce of copper deposited. Copper melts more easily than gold, less easily than silver. The melting point of copper is about 2,450 degrees Fahrenheit.

METROPOLITAN REALTY BUILDING,

214, 216, 218 William St. and 18-20 Rose St.

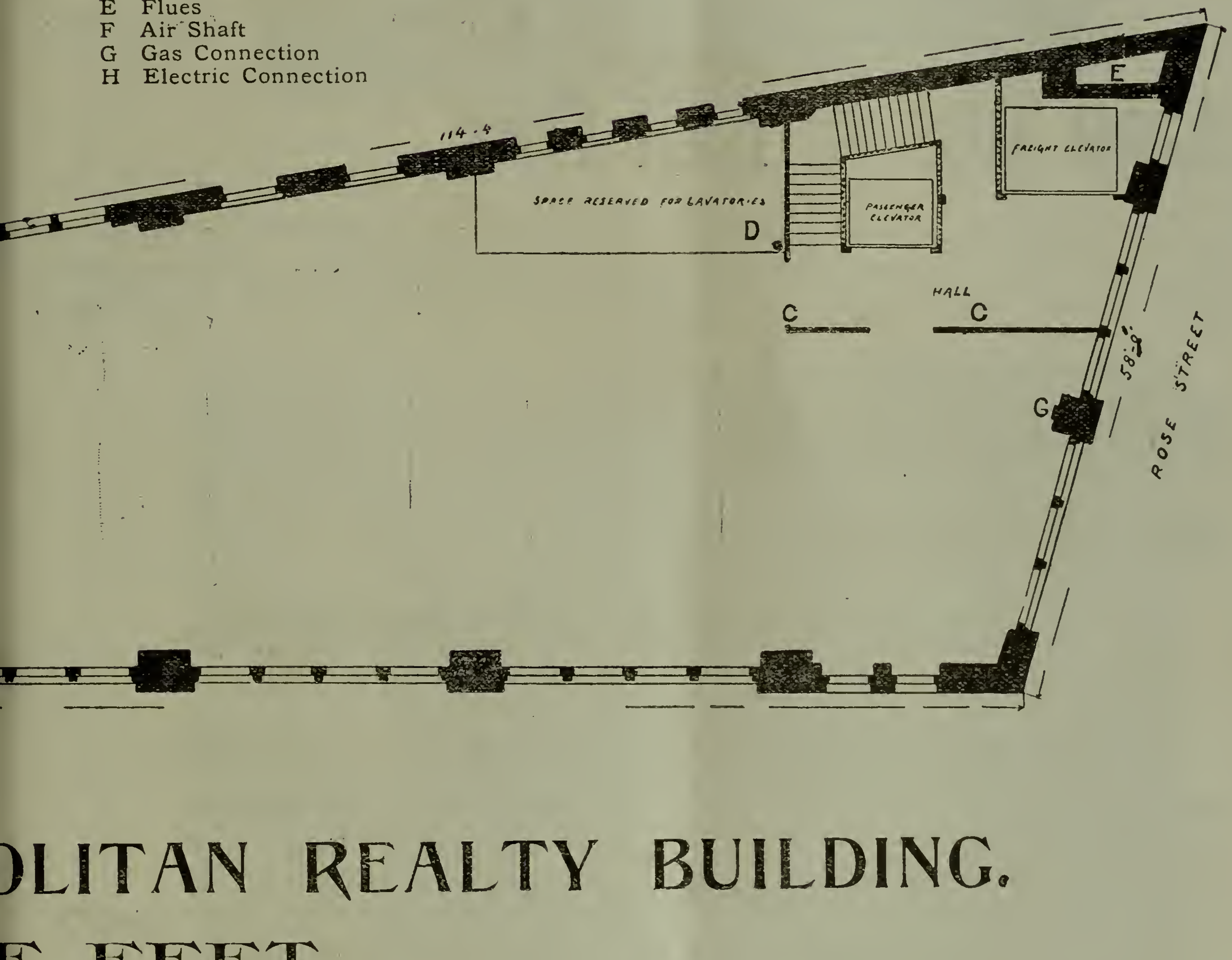


FLOOR PLAN OF THE METR

10,000 SQU

10th and 12t

A Watchman's Clock
C Fire-Proof Partitions
D Fire Hose
E Flues
F Air Shaft
G Gas Connection
H Electric Connection



LITAN REALTY BUILDING.

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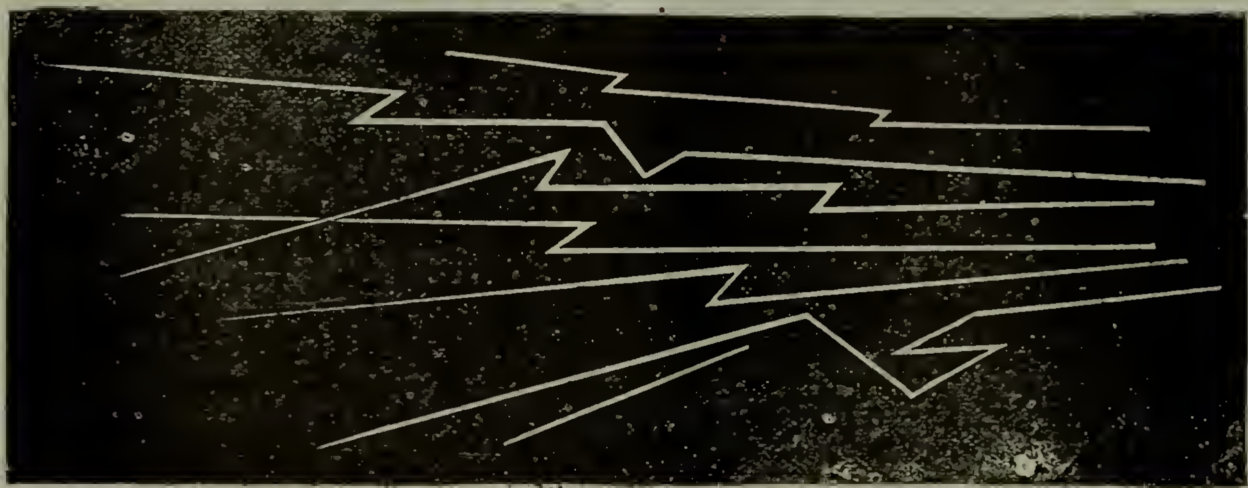
ELECTRO STATICS.

LIGHTNING DISCHARGES.

According to Tesla, the frequency and pressure of a discharge alter in every respect the familiar relations existing between current, electro-motive force and re-

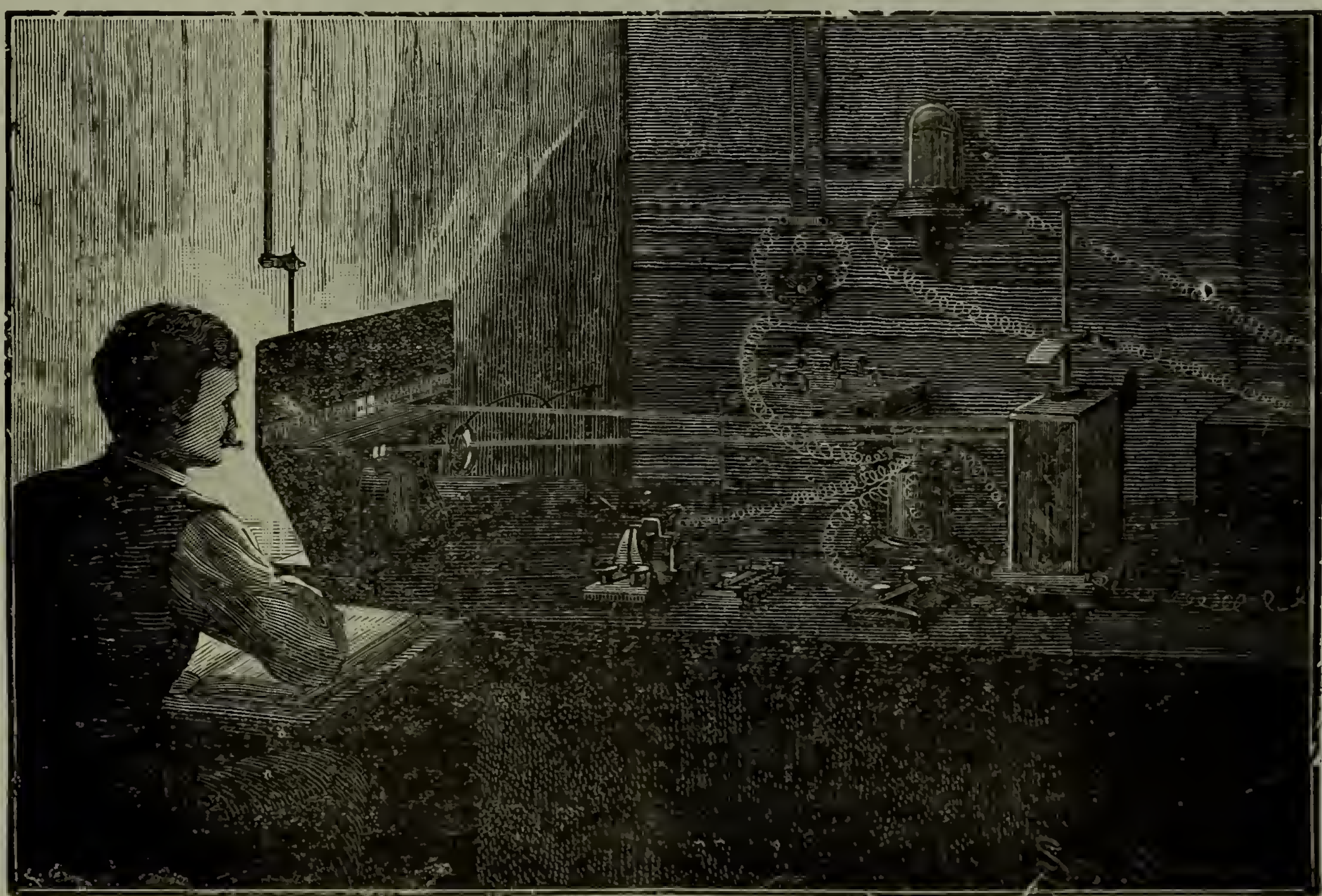


sistance. A lightning discharge represents a succession of alternations or oscillations of high frequency and enormous potential. It is almost impossible to estimate the force of a lightning discharge in horse power. It is well-known that at least ten thousand volts is required to jump an air space of less than one quarter of an inch. Whatever law governs the relations of pressure and distance there is but little known except the fact that frequency will increase or diminish it according to the medium through which the discharge passes. A lightning discharge a mile long on the basis of ten thousand volts per foot would require a potential difference of ten thousand times five thousand two hundred and eighty volts, or a total of 52,800,000. The current according to German scientists would melt a large iron nail in less than a second. About one thousand amperes is required for this. Consequently, a single lightning discharge may represent for one second an outburst exceeding five million horse power.

THE MEASUREMENT OF CURRENT.

GALVANOMETER MEASUREMENTS.

The amateur experimenter is apt to find that galvanometer measurements try the patience more severely than any other test of common laboratory experience. The time taken up in preparing a galvanometer for experimental purposes is sometimes sufficiently long to make a test painful to contemplate. A radical cure for many of the defects of galvanometer work may be found in the construction of the fibre. The accuracy of the test and



Connections of Galvanometer to Shunt and Key.

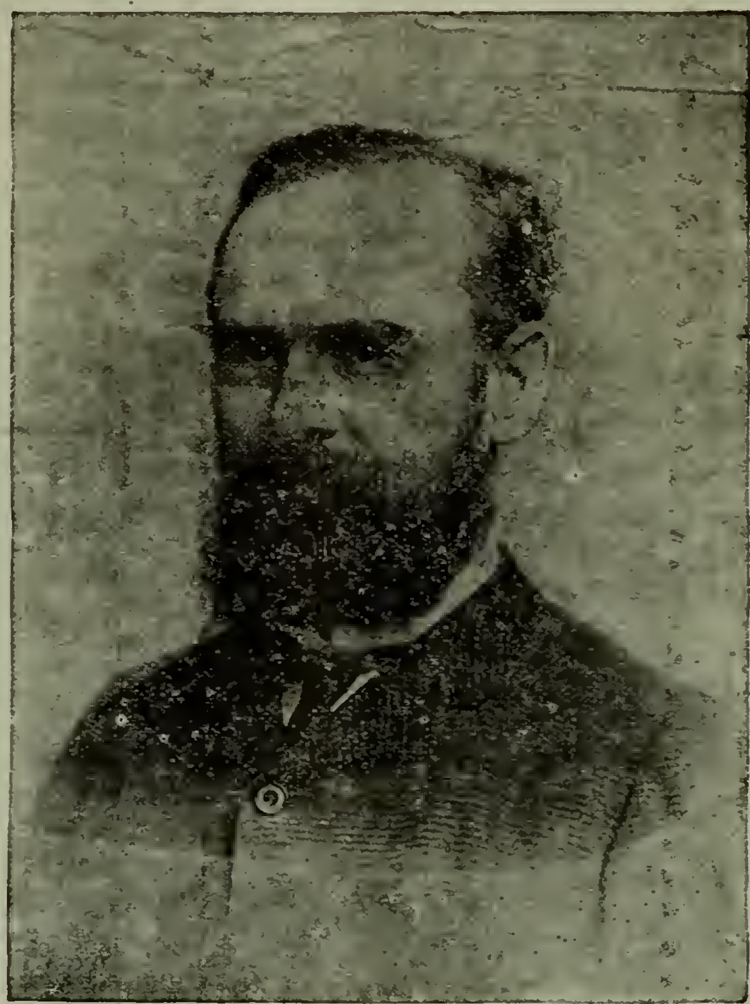
the satisfaction accruing from the same depends entirely upon the reliability which may be placed in he fibre supporting the mirror. The writer made a series of tests with a variety of fibres, such as a single thread of unspun silk, a fibre of glass and finally a fibre of quartz. The fibre of silk after being moistened and allowed to twist and untwist itself while supporting a weight after twenty-four hours was still unsatisfactory. The glass fibre was so rigid for delicate tests as to prove thoroughly unsatis-

factory. On the other hand a fibre of spun quartz for galvanometer or electrometer work cannot be equalled by any known supporting device of so fine a nature. To prepare a quartz fibre, a swinging arm of wood operated by a trigger and describing an arc of four foot radius with a clamp at one end is required. The clamp holds a quartz pebble against another quartz pebble, held by a similar clamp fastened to an immovable board to which the swinging arm is hinged. An arc lamp melts the quartz pebbles and when the proper point of fusion has been reached the trigger is pulled. A fine filament results, which for galvanometric purposes, is without question, unmatched for reliability.

OBITUARY..

JESSE H. BUNNELL.

Jesse H. Bunnell, of the firm of J. H. Bunnell & Company, of Manhattan, manufacurers of electrical supplies, died February 8th, of heart failure. Mr. Bunnell was 57 years old, and leaves a widow and four children. The funeral was held at St. John's Episcopal Church, Seventh avenue, Brooklyn, February 10th.



Jesse H Bunnell.

As an old time telegrapher, says the "Brooklyn Daily Eagle," Mr. Bunnell was known either personally or by reputation, in all the telegraph offices in the United States. When the war broke out he was one of the first to enter the service of the United States in the Military Telegraph service.

Mr. Bunnell was born in Massillon, O., in 1843. In 1854 he entered the telegraph office in Massillon as a messenger and there learned to operate. From 1850 until 1861 he was employed as operator at various places.

From April, 1861, to August, 1864, he was with the Army of the Potomac at the headquarters of McClellan and Burnside, and with the Army of the Cumberland, with Rosecrans, Thomas and Sherman.

After the war Mr. Bunnell was for a time a member of the firm of Patrick, Bunnell & Co., of Philadelphia Later he came to New York and for a short time was associated with L. G. Tillotson & Co., on Dey street. About twenty years ago he became associated with Charles McLaughlin as J. H. Bunnell & Co. at 76 Cortland street, and the firm has been continued ever since. Mr. Bunnell was a member of many of the associations and organizations connected with his line of business and with others having to do with the war. Mr. Bunnell's death will not interfere with the business, which will be carried on as usual under the title of J. H. Bunnell & Co.

ELECTROLYSIS.

ELECTRICITY IN THE SEPARATION OF METALS.

What has been accomplished by the use of electricity in separating the metals on a large scale can be seen from the following data: In 1897 one-third of the entire copper produced (137,000,000 kilograms) was obtained electrolytically. The larger part of the gold and silver were obtained in the same way. Sodium is produced entirely by electrolysis (260,000 kilograms in 1897), and the increase in the aluminum produced, from 9,500 kilograms in 1888 to 321,000 kilograms in 1894, is to be referred to the same cause. This aluminum can now be used for the preparation of other metals which were difficult to obtain. At the last meeting of the Electro-Chemical Society, in Leipsic, almost chemically pure chromium was prepared by suitably igniting a mixture of aluminum and chromium oxide. In the same manner manganese, titanium, tungsten, vanadium, cerium, etc., were found. This opens up a field in the metal alloys which will, perhaps, be of technical importance.—Science.

Some of the principal carbon interests in the United States will shortly be consolidated in a new organization, to be known as the National Carbon Co., with a capitalization of $10,000,000.—Ex.

It is believed that the exports of American electrical machinery for 1898 will exceed $2,000,000.

ELECTRIC NOVELTIES.

"MATCHLESS" ELECTRIC LIGHTER.

If an estimate were made of the expense caused by the

Matchless Electric Lighter to be Fastened to Wall.

ruthless and careless scratching of furniture, walls and woodwork, by smokers and servant girls, it would probably rise to enormous figures. Trains, hotels and apart-

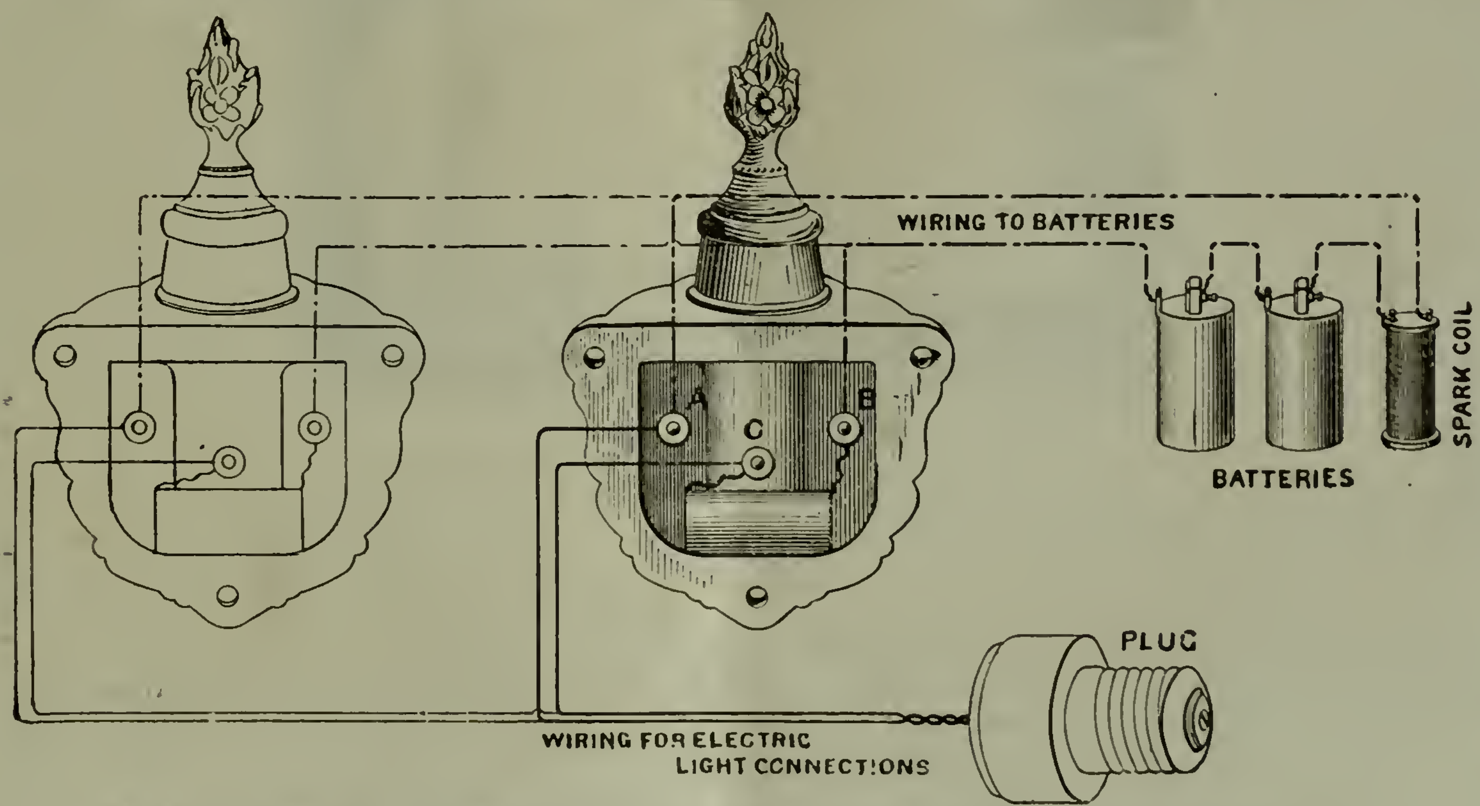


Diagram of Connections for Matchless Electric Lighter, Either for Batteries or Lighting Circuits.

ment houses suffer the most. In addition to this the risk of fire due to the dropping of lighted matches has increased within the last few years to such an extent that if this deed were considered a misdemeanor, punishable by a fine, millions of dollars would roll into the till of Uncle Sam each year. The "Matchless" electric lighter, costing about one cent a month, obviates all these difficulties. It is shown in the illustrations with connection for battery or electric light circuits. A few dry cells and a spark coil are all that is required, consequently, the "Matchless" electric lighter cannot get out of order unless it is abused. By removing the top piece the spark coil, at the instant of breaking contact with two spring clips, creates a flash and ignites the lighter which is as serviceable as a match and for a much longer period. Mr. Howard Gould's steam yacht "Niagara" has been supplied with thirty-eight of the "Matchless" electric lighters.

In marine service they have become popular and the United States Navy has them under consideration for her coast defenders. The professional smoker, the cigarette "fiend," who is always without a match, and the house maid, when once accustomed to the "Matchless" electric lighter will regard it as an absolute necessity. They are manufactured by Stanley & Patterson, general electrical equipment and supply dealers, 32-34 Frankfort St., New York City.

CONVENTIONS. MEETINGS OF THE AMERICAN STREET RAILWAY ASSOCIATION AND THE STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

The Eighteenth Annual Meeting of the American Street Railway Association, and the Third Annual Meeting of the Street Railway Accountants' Association of America will be held in Chicago, Ill., October 17, 18, 19 and 20, 1899, at "Tattersall's," State and Sixteenth Streets.

President, Charles S. Sargent, of Boston; Secretary and Treasurer, T. C. Penington, of Chicago; Walton H. Holmes, of Kansas City; Albion E. Lang, of Toledo; George A. Yuille, of Chicago; Frank G. Jones, of Memphis; John I. Beggs, of Milwaukee, and Ira A. McCormack, of New York, members of the Executive Committee of the American Street Railway Association, met in Chicago, February 6th and 7th, and completed all the preliminary arrangements for the convention. The hall is well suited to the purposes of the exhibit, having a clear floor space, without columns, of 50,000 square feet. The banquet will be given on the night of the last day of the convention, at which the installation of the newly elected officers will take place. The hall will be well lighted and heated; the light during the hours of the day leaving nothing to be desired. All the exhibits will be on the same floor, and there will be little choice as to location. All electric power necessary will be furnished. The hall is within three hundred feet of the steam railroad tracks, and a special siding will be laid to the rear door of the hall, so as to bring the heavy exhibits direct to the hall.

The following subjects were selected, upon which papers are to be read at the meeting: "Maintenance of Car Equipment;" "The Modern Street Railway Shop; Its Design, Machinery and Shop Practice;" "Train Service, and Its Practical Application;" "Investment in Street Railways; How Can They Be Made Secure and Remunerative?" "Construction and Maintenance of Railway Track." The Headquarters of the Association will be at the Auditorium Hotel and Auditorium Annex.

Pedestal Style of Matchless Electric Lighter.

ELECTRIC RA WAYS.

COLD CARS IN THE BRONX.

The cold storage system of car heating employed by the Union Railway Company, says the "N. Y. Times," proved an unqualified success in keeping the temperature in the company's cars several degrees below that out of doors. On some of the cars coming in from Mount Vernon and other points in the early morning it is said that the passengers were obliged to go out on the platforms to get warm. In line with this, one wideawake patron of the road called up the company on the telephone during the day and suggested that they call in the closed cars and send out open ones, so that the passengers might enjoy the comparative warmth of out-doors without having to ride on the platforms.

A delegation of angry Bronx citizens, with blue noses and with icicles dangling from beards and mustaches,

called at the office of the local Board of Improvements of the Borough of Bronx, to complain against the Union Company's refrigerator cars. The spokesman of the delegation, as an introduction to his remarks, exhibited an ear which he declared had been frozen in one of the company's cars.

"I looked at a thermometer on the street corner before boarding the car," he said, "and it registered 4 degrees above zero. When I got aboard the car I consulted a small thermometer which I always carry in my pocket, and, you may believe it or not, but the mercury was making a frantic effort to climb out through the bottom of the bulb. When the conductor asked me for my fare he just had to break off his breath in order to articulate. Why, when I finally left the car and got in the open air the change in temperature so wilted me that I went into a corner saloon and got the bartender to turn on an electric fan so that I could cool off."

We would advise prospective Klondikers to spend a short time on the above line before embarking for the frozen North, in order to inure themselves to the icy blasts which abound in the northern El Dorado.

BUSINESS NEWS

SPECIAL EXPORT COLUMN. TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING, FEB. 7, 1899, $78,522.00.

New York, N. Y., Feb. 7, 1899.—The following exports of Electrical Materials, etc., are from the port of New York for the week ending this date:

Antwerp.—54 cases electrical material, $2,235.

Alexandria.—3 packages electrical material, $200.

Africa.—36 packages electrical machinery, $10,733; 1 case electrical material, $31.

Argentine Republic.—40 cases electrical machinery, $2,673; 84 packages electrical material, $2,818.

Berlin.—4 packages electrical material, $130.

British Guiana.—10 packages electrical material, $150.

Berlin.—7 cases electrical material, $350.

British West Indies.—25 cases electrical material, $803; 1 case electrical machinery, $45.

Cuba.—27 packages of electrical material, $343; 9 packages electrical machinery, $393.

Chili.—9 cases electrical material, $413.

Central America.—1 case electrical material, $48.

Dublin.— 1 case electrical machinery, $998.

Havre.—1 case electros, $15.

Hamburg.—32 packages electrical material, $6,329; 84 packages electrical machinery, $6,750.

Hull.—120 packages electrical machinery, $15,075.

Liverpool.—65 packages electrical material, $2,381.

London.—6 cases electros, $217; 152 cases electrical material, $6,040; 23 cases electrical machinery, $2,298.

Mexico.—69 packages electrical machinery, $6,703; 2 packages electrical material, $14.

Porto Rico.—14 cases electrical material, $544.

Santo Domingo.—7 cases electrical material, $160.

Southampton.—1 case electrical material, $12.

Stettin.—29 cases electrical machinery, $8,740.

U. S. of Columbia.—8 packages electrical machinery, $358.

Venezuela.—7 cases electrical material, $419.

Zurich.—3 packages electrical material, $104.

NEW INCORPORATIONS.

Tacoma, Wash.—The Tacoma Railway & Power Co. has been organized to furnish electric power for railroad and manufacturing purposes at Tacoma, Wash., and to operate street railroads. It is understood that the electricity will be generated from water power in that State. The company is capitalized at $2,000,000.

San Francisco, Cal.—The Yuba Electric Power Co. has been incorporated with $1,000,000 capital stock.

Norfolk, Va.—The Norfolk New Light Co., capital stock $5,000, has been incorporated for the purpose of erecting and maintaining heating or lighting plants, etc.; officers, W. H. Davis, Sr., president; E. M. Henry, vice-president and general manager, W. H. Davis, jr., secretary and treasurer.

New York City.—A syndicate composed of Moore & Schley, Emerson McMillin & Co., H. B. Holins & Co., Wood & Havermeyer and John C. Tomlinson has secured control and will consolidate the gas and electric light properties of Denver, Col. Two companies will be combined, the Denver Consolidated Gas Co. and the Denver Consolidated Electric Light Co. The new company, which will be organized, will be authorized to issue $3,500,000 stock and $5,500,000 5 per cent. fifty-year gold bonds.

STREET RAILWAY NEWS.

Mount Airy, N. C.—Philadelphia parties have been examining a route between Mount Airy and Sulphur Springs, about four miles distant, with the idea of constructing an electric road to the latter resort.

Kansas City, Mo.—The Missouri Electric Railway Co. has been formed, with $500,000 capital stock, by Henry Smith, Frank W. Sears and others.

Kansas City, Mo.—The Kansas City Interurban Railroad Co. has purchased the Westport & Waldo and the Eastern railways, and will change them to trolley lines or some other electric system.

Bessemer, Ala.—W. T. Kennedy and others have asked for a franchise from the city to build an electric line along several streets.

POSSIBLE INSTALLATIONS.

Greenwood Depot, S. C.—Miller Manual School contemplates the erection of a power house. Professor Vawter can be addressed.

Franklin, Fla.—The Franklin Electric Co., recently noted as incorporated, completed its plant for lighting in December last.

Birmingham, Ala.—A bill has been introduced in the legislature authorizing the city to issue bonds for construction of or purchase of water works; also authority to issue bonds for buying or erecting electric light plant is authorized.

Elizabethtown, N. C.—By a unanimous vote of the city council R. L. Wintersmith, mayor, has been authorized to advertise at once a franchise for twenty years to put in electric lights.

Middletown, Conn.—The city of Middletown, Conn., will have a municipal lighting plant. The mayor may be addressed.

Niagara Falls, Ont.—The power station and plant to be erected by the Canadian Niagara Power Co., at Niagara Falls, Ont., is expected to develop at least 10,000 horse power.

Portland, Me.—U. S. Engineer Office, 537 Congress street, Portland, Me.—Sealed proposals for furnishing and setting up electric lighting plant at Fort Preble, Me. will be received here until 12 M., March 6, 1899, and then publicly opened. Information furnished on application. S W. Roessler, major, engineers.

TELEPHONE CALLS.

Rockingham, N. C.—The Pee Dee News Transit Co. has applied for charter for the construction of a telephone system; capital stock $25,000; incorporators, W. H. Smith and J. T. Dunlap, of Wadesboro, N. C., and J. L. Bundy, of Rockingham.

Kansas City, Mo.—Geo. F. Putnam has incorporated the Independent Telephone Co., capital stock $300,000 The incorporators are G. F. Putnam, R. H. Kent, E. O. Moffat and others.

Rogersville, Tenn.—The Tennessee River Telephone Co. has been incorporated, with a capital stock of $1,000, by J. R. Roark, T. R. Webster, R. D. Kelier, J. R. Sanders and J. D. Walker,

Hoyes, Tenn.—The company reported being organized by W. A. Smith and others for the establishment of a telephone system, will be known as the Cranesville, Friendsville & Oakland Telephone Co. The company is constructing a line twenty-five miles long, and when that is completed will construct forty miles additional.

Maysville, Ga.—M. C. Russell & Son, Brittain & Lloyd, T. C. Winter, Judd & Co. and others have incorporated the Germantown, Minerva & Maysville Telephone Co., with a capital stock of $500.

Louisville, Ky.—The Ohio Valley Telephone Co. will increase its capital stock from $100,000 to $550,000. The company contemplates making some improvements to its plant.

Fordsville, Ky.—The Fordsville-Harrison Telephone Co. has been incorporated for the construction of a telephone system from Fordsville to Owensboro. John T. Smith, Jr., is president; Dr. E. W. Ford, of Hartford, vice-president; Ike C. Adair, treasurer, and J. D. Cooper, secretary; capital stock, $1,000.

JOTTINGS.

CROUSE-HINDS ELECTRIC CO., of Syracuse, N. Y., are sending out a portfolio entitled "Official Endorsements," containing about thirty testimonials regarding the "Syracuse Changeable Headlight." Judging from the tone of the various letters the headlight seems to have in the vernacular, "touched the spot."

JAMES LEFFEL & CO. Springfield, O., manufacturers of water wheels, will erect a new factory in order to double their capacity for castings.

GEO. A. HAMILTON, the chief electrician of the Westery Electric Co., of Chicago., has gone to England and France on business for the company.

E. H. JOHNSON, Derby, Conn., manufacturer of lead covering and insulating presses is equipping the Hazard Manufacturing Co., of Wilkesbarre, Pa., with his machines, to be used in the manufacture of insulated wire. This company is an old copper wire manufacturing concern and has its New York office at 50 Dey street.

CHARLES F. MUNDES, treasurer and manager of the Davis Electrical Works, Springfield, Mass., was in town lately taking orders.

HAILEY, STANCLIFF & REED, 61 Cortlandt street, organized January 1, 1899, dealers in new and second hand dynamos and motors, are prepared to install complete plants for electric light and power. They also make a specialty of electric signs, experimental work, wiring, &c. The firm is composed of Robert E. Hailey, Edwin Hancliff and Irving L. Reed.

STRONG & TOTTEN, 123 Liberty street, have opened up offices as general electrical contractors.

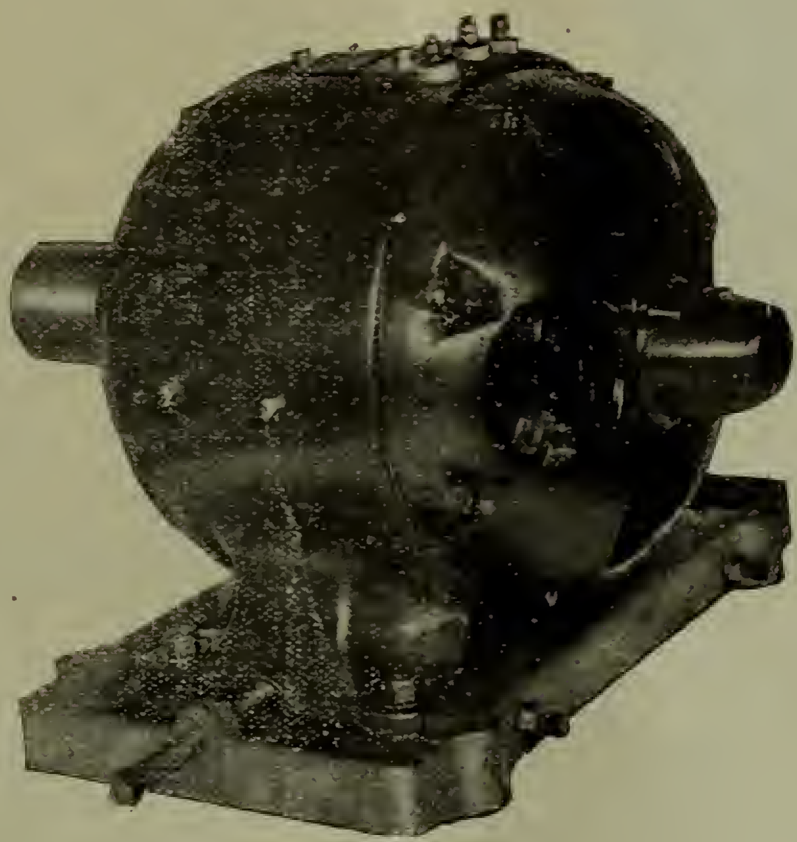
AMERICAN IMPULSE-WHEEL CO., 120 Liberty street, report some very large electrical transmission work in hand and most valuable results from all their installations. The company is getting a large home and export trade.

THE CABLE STEAMER PANAMA, which leaves New York for Manilla on March 15 will have on board 150 miles of safety and 50 miles of "Kerite" cable, to be used in completing telegraphic communication between the various islands of the Philippine group.

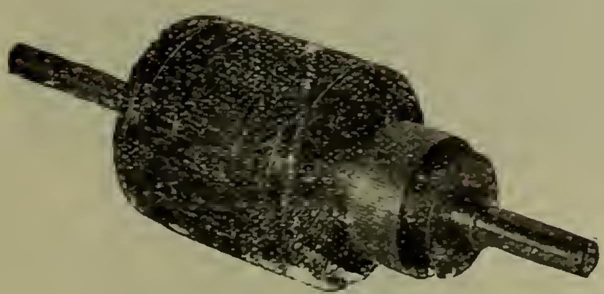
The Electrical Age.

VOL. XXIII—NO. 8 NEW YORK, FEBRUARY 25, 1899 WHOLE NO. 61

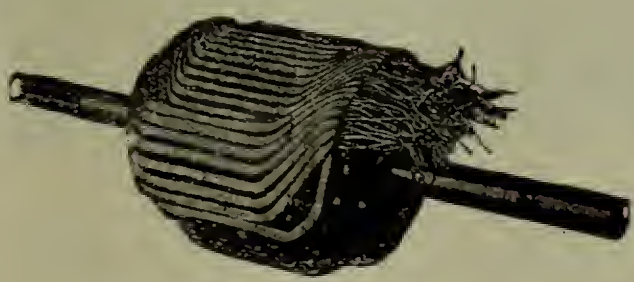
ELECTRIC LIGHT AND POWER.



C. E. Motor.



C. E. Armature.



C. E. Motor Armature Without Coils,

STATIONARY MOTORS FOR POWER PURPOSES.

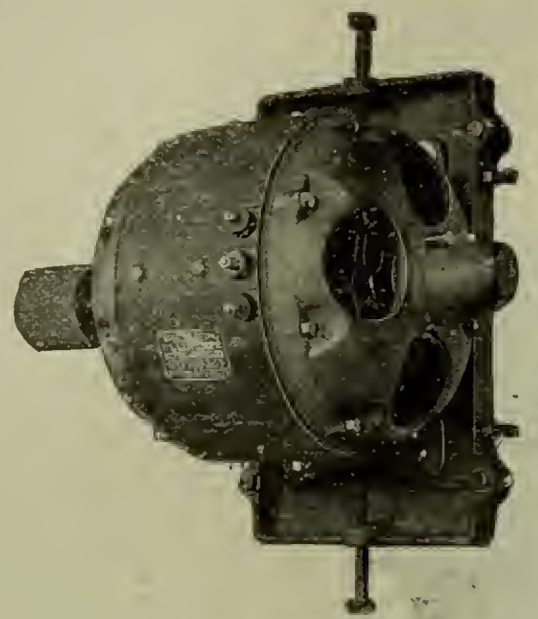
To meet a demand for larger direct current stationary motors as compact and efficient, motors of the type C.A., which range from 1-8 h.p. to 2 h.p., the General Electric Co. has perfected a line of motors known as the type C.E. These embody all the features of excellence characteristic of other G.E. motors, as well as the latest ideas in motor construction. Designed by experienced engineers and built by skilful workmen using the best material, they are constructed to withstand the severe usage which motors are apt to receive. Moreover, the design is such that it may readily be modified to meet special requirements.

The motor frame which is also the magnet yoke, is of soft steel of high permeability. It is cast in the form of a hollow cylinder with projecting feet, on the outside, and seats for the pole pieces on the inside. The short magnetic circuit which this arrangement gives and the use of the best material, contributed to make the new motor efficient in all its capacities. To obviate oddy current losses the pole pieces are built up of iron laminations, and are secured to the yoke by through bolts with nuts on the outside. The field coils are held in place by the extended lips of the pole pieces and as the face of the pole piece covers a large surface of the armature, without increasing the size of the field coils the efficiency of the motor is materially augmented.

The armature is built up of iron laminations assembled directly on the shaft. To prevent oddy currents, each sheet is japanned on both sides and good ventilation to core, and winding is provided by air ducts. The laminations are clamped solidly between two cast iron spiders, extended at each end as flanges to support the coils.

The armature coils of copper wire, form wound, insulated and tested, are placed in the core slots, the ends of the coils lying along the flanges. This arrangement constitutes the "cylindrical" armature winding. As it pro-

vides a large ventilating surface for the conductors and reduces the length of wire necessary with consequent decreased resistance, it conduces to coil running high, efficiency as well as to ease of removal and replacement of any coil. The insulation employed is that used with all G.E. railway motors, and is tough, impervious to moisture, and practically indestructible. The coils are securely held in a rigid position and injury to the insulation from sliding or vibration is impossible.



C. E. Motor. Wall Suspension

The commutator and brush holders are of the types used wth G.E. railway motors. The segments are of hard drawn copper, insulated by mica, which between the segments wears evenly with the copper. The armature leads are soldered into slots in the segments and being short are not liable to become displaced and, abrading the insulation, cause a short circuit. The brush holders are of cast brass arranged for radial carbon brushes, which slide in finished ways, and are pressed against the commutator by independent pressure fingers, giving uniform pressure throughout the life of the brush. There is no sparking and change, from no load to full load requires no shifting of the brushes. The only wear on the commutator is that of friction, and the use of carbon brushes renders this negligible.

The bearings are supported by cast-iron and shields. This method of support is lighter, but not less rigid, than pillow blocks, and while affording protection to the working parts, does not lessen the compactness of the motor. Furthermore, the motor being symmetrical, a simple quarter or half turn of the end shields allows it to be fastened to a wall or be suspended from the ceiling. The end shields have hand-holes, which provide ventilation and give easy access to the working parts. In motors intended for use in dusty places, these hand-holes may be covered by wire screens, which offer little resistance to the air, and for continuous service are superior to solid covers. The bearings have ample surface to ensure cool running and are automatically lubricated. The linings are of gun metal, in one piece, and rest on the bearings throughout their entire length, being kept from turning by dowel screws extending through the bearing castings. The small number of machined surfaces brought together eliminates trouble in lining-up the motor, and renders the spherically seated bearing unnecessary.

Slow speed in motors means diminished losses by wear and friction of belting, bearings and commutator, but as decrease in speed, necessitates a corresponding decrease in output, in motors of a given design, a reduction in speed requires a heavier and more expensive machine to give the same output. The most economical speed for a given duty is determined by a careful consideration of the relative advantages to be derived from a slow speed and the increase in cost required to obtain it. In the motors under consideration, the four pole construction has been adopted for all sizes down to and including the three h p. slow speed motor. By the adoption of this construction, the use of a steel magnet yoke, and the use of end shields to support the bearings, an economy of material is effected, which permits, without sacrifice of strength or stability, of the construction of motors much lighter for a given output than other machines running at even higher speeds. The magnetic material is economically arranged, the machines are light and compact, the centre of gravity is low, and the floor space occupied small.

The C.E. motors are built in capacities of from 2 h.p. to 10 h.p. in slow speeds, and from 3 h.p. to 15 h.p. in moderate speeds. They are conservatively rated, and will run under full load at an unusually low temperature. The standard type will deliver the rated output continuously without rising in temperature above 40 degrees C., above the surrounding air. With the wire screens over the hand-holes this will be slightly exceeded. The motors will carry a temporary overload of 40 per cent. without injurious heating. Following its usual practice, the General Electric Company makes all parts of these motors to gauge, and duplicate parts can thus be obtained without delay.

THE GENERATION OF THERMO ELECTRICITY.

Various experiments have been attempted for the purpose of discovering a means of producing thermo electricity economically. From a commercial standpoint, failures have been about the only reward inventors and experimenters have received.

The antimony and bismuth couple is little or no better

Fig. 1.

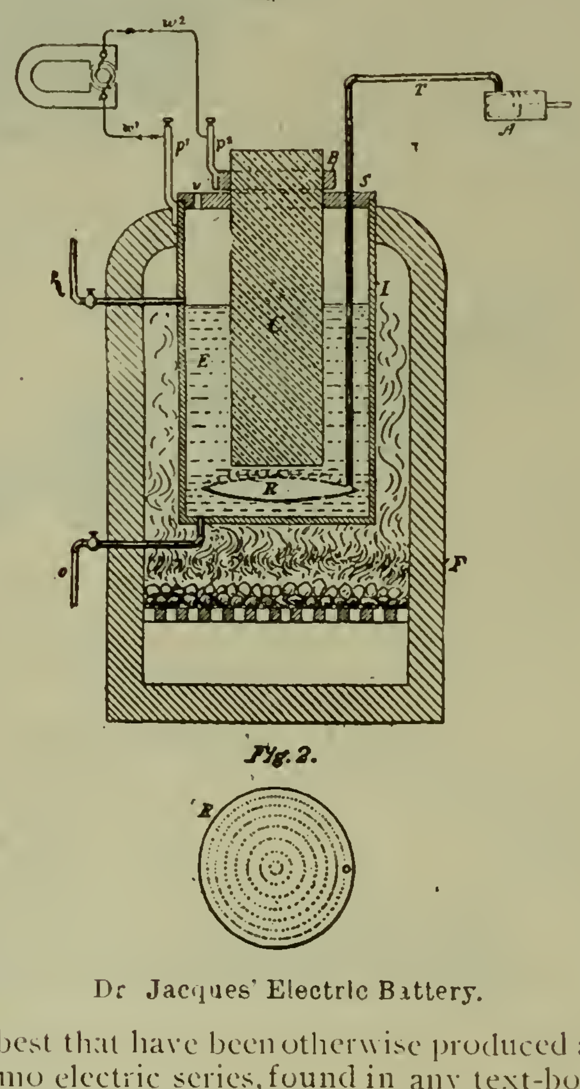
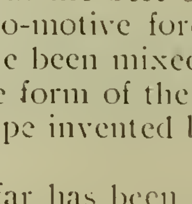


Fig. 2.



Dr Jacques' Electric Battery.

than the best that have been otherwise produced and used. The thermo electric series, found in any text-book, show that selenium is about the best of known metals for the production of electro-motive force from heat. Various ingenious alloys have been mixed and tried but it seems as though the future form of the thermo electric battery will be one of the type invented by Dr. Jacques, of Boston, Mass.

The difficulty so far has been the deterioration of the joints between the couples. This has been largely overcome by employing a fluid which acts as a connecting

medium between the two elements and assists in keeping the electro-motive force high, and the current constant. Many crystallized minerals have great electro-motive force when heated with metals or with each other. Iron pyrites give one-fifth of a volt with copper and pyrites.

Bacquerel built a battery in which artificial suphuret of copper was used in connection with German silver, an alloy of copper and nickel. Claymond built a battery which has been used for electro plating and telegraphing. The negative element is composed of antimony and zinc, an alloy; the positive element merely a strip of tin. Illuminating gas was used and in larger sizes coke for producing heat. A battery of sixty couples gave three volts and two amperes; consuming per hour about three cubic feet of gas.

About the best combination so far is illustrated. It consists of a rod of carbon immersed in a heated, or rather melted, solution of caustic potash contained in an iron pot. A coal fire is built underneath. A connection is made from the iron pot and carbon cylinder. A battery of this description gives excellent results, when a supply of

The Jacques Battery in Operation.

air is blown through the molten potash. About one hundred and twenty of such cells gave a current sufficient to feed thirty lamps for eighteen hours, each lamp of one hundred and ten volts and half ampere consumption. The commercial application of such a cell might be eminently successful if all that is required in the line of attention is the shovelling of coal.

NERNST'S ELECTRIC LIGHT.*

By James Swinburne.

Before describing Nernst's invention, it may be profitable to spend a few minutes reviewing the position of electric lighting. The whole industry is at present controlled by the incandescent lamp. We are so accustomed to this, and it is taken for granted in such an unconscious way, that we do not realize how much everything depends on the maker of the carbon incandescent lamp.

In very early days—that is to say, in the early eighties—there were a few Edison lamps at 100 volts, with an efficiency too horrible to mention, but the Swan lamp came along made for 50 volts. I say made for 50 volts advisedly; I mean that the makers tried to make 50-volt lamps, and produced lamps taking from 40 to 60 volts. If the lamps were not bright enough you ran the engine faster, or put a smaller pulley on the dynamo. (The belt then generally slipped; but that is not to the point. For about four years, which is a long period in the development of such a rapidly growing industry as electrical engineering, the makers of incandescent lamps, or, in fact, the makers of the Swan lamp, decreed that the E. M. F. used should be from 40 to 60 volts. There was no appeal. There was no development of central-station supply at that time, but still, even then in large buildings there was the longing for higher pressures on account of the cost of the mains.

About 1885 the Swan 100-volt lamp came into use. It was a clumsy affair with little loops of platinum at the sides. At first the lamps were pretty bad but they gradually improved, and 100 volts, or in some cases 110 volts, became the recognized pressure for electrical supply.

As town lighting from central stations came into being the limit of 100 volts became a serious trouble, and the evil was partly mitigated by the use of three or even five wire systems. I must point out that the incandescent lamp exercises its tyranny in two ways. It not only insists on a low pressure, such as, say, 100, and thus demands large leads to feed it, but it is so sensitive to variations of pressure that the system of distribution has to be arranged to give a practically uniform pressure at the terminal of the lamp. The necessity for uniform presure probably gives more trouble and costs more than the mere low pressure, and it would be cheaper to supply at 100 volts with a good margin of permissible variation of pressure than supply at 200 with a very small percentage of variation.

Quite lately the incandescent lamp makers have produced things called 200-volt lamps, and some make them for 250 volts. So there is a general tendency on the part of supply companies to jump to a 200-volt supply. The innocent consumer is therefore pressed by the company to change over to 200 volts. The company likes the change very much, and the lamp maker also enjoys it, as he makes more lamps and charges more for them.

Considering the enormous importance of the incandescent lamp, its improvement has received extraordinarily little attention. It limits us as regards pressure, it used to hamper us by its cost, it limits us as to variation of pressure, and it limits us very seriously by its inefficiency. Yet, in spite of these, the carbon incandescent lamp has made practically no advance in 15 years. Of course mere detail improvement in manufacture has taken place, and this has led to better quality and greater uniformity, hence cheapness; but there has been no radical improve-

*Paper read before the Society of Arts, London, Feb. 8, 1899.

ment. The jump from 200 volts to 100, of from 50 to 100, did not depend on any sort of radical improvement in the incandescent lamp; it was merely the result of detail improvements making it possible to produce long thin filaments. Other things being equal, it is easy to see that the long thin filaments must be weaker. If the carbon has the same specific resistance, the relation between pressure and length is E equals L3-2, and E equals D3-2. If the filaments are flashed, the proportions will be still more extreme. The question of high-pressure incandescent lamps is thus, how far can we make the filaments longer and thinner and flimsier without exasperating our consumers? Unfortunately the consumer is rapidly getting saddened as it is. The 100-volt 8-c.p. lamp does not please him much, and the 200-volt 8-c.p. lamp has in no way delighted him; if the lamp is made with two 100-volt filaments in series, it combines the disadvantages of both without the advantages of the small candle-power of either. But it adds some further disadvantages peculiar to the higher pressure which I have not so far touched upon—and that is, that the higher the pressure the more troubles there are through the silent discharge, or whatever it is called. I need only refer to the well-known experiment in which third terminal is sealed into the lamp. A galvanometer then shows a current going across country inside the lamp. This is, no doubt, intimately connected with the life, or rather with the death of the lamp.

I have dealt with the question of high-pressure incandescent lamps at some length because the subject is really of vital importance, and is too much neglected. Our technical colleges, and our technical Press, and our technical societies pay the greatest attention to questions of a per cent. or two in the efficiencies of dynamos and transformers, and give a good deal of attention to engines and boilers. That is because there is plenty of room for calculations in connection with these subjects, but the incandescent lamp which at present holds the whole career of the lighting industry in the curl of flimsy red-hot carbon that can hardly support its own weight, receives no attention at all. How much does the average electrical engineer know about incandescent lamps? The only subject that is treated in the same way is the cable. About half the money in town-lighting goes in the cable—a mere fraction in the dynamos and transformers themselves—so the average electrical engineer knows nothing about cables.

So far I have only discussed the incandescent lamp; the arc lamp has also to be considered. I will not say much about the arc lamp just now, but will add a little more when the Nernst lamp is compared with it. The ordinary arc is limited in pressure to about 50 volts, including the series resistances necessary for regulating. The enclosed arc is a new development, which is more satisfactory as regards pressure and as regards consumption of carbon.

The lamp I describe to-night is the invention of Prof. Walther Nernst, of the University of Gottingen. Though he is a young man Prof. Nernst's name is already known to all modern chemists as a leading authority and original thinker in the field of physical chemistry. It is unusual for a man who has climbed to the top of one tree to jump to the top of another.

Nernst's, like most great inventions, is exceedingly simple as soon as it is understood. The efficiency of an incandescent body, as far as radiation goes, depends simply on the temperature. The efficiency of an incandescent lamp, for instance, depends upon the temperature of the filament only, providing there is no loss by convection. The carbon will not stand a sufficiently high temperature especially as, in addition to its low specific resistance, the filament has to be long and slender, and thus weak. Nernst, therefore, chose a material that would stand higher temperatures than carbon, and his material has the incidental advantage that its specific resistance is so high that strong rods can be used for high pressures instead of thin filaments. The most refractory materials so far used in lighting are zirconia, which has been used to replace lime in the limelight, and the oxides or so-called rare earths, in the Welsbach mantles. I am aware, of course, that many people suppose that the Welsbach mantle is not very hot, treating it as if it were at a temperature for instance below the melting point of platinum. The light emitted is supposed to be due to some special power of selective emission due to the oxides employed. I have had a good deal to do with incandescent gas mantles, and I find no reason to suppose there is any magic effect of this sort going on. The part of the flame where the mantles hang fuses platinum wire easily, and very few materials can stand the temperature without fusing or volatilising. Lime and many other oxides volatilise slowly from the mantles. I do not mean that the mantles are above the boiling point of lime; I have some idea of its melting point, as I have made a few pounds of melted lime and ran it out on the floor to look at it. The Welsbach mantles, which are now chiefly thoria, are at a temperature near their softening point, and in the making are raised to a temperature at which they begin to soften.

Nernst takes highly refractory oxides as his material. It does not seem promising, because such oxides are notoriously good insulators. But such insulators are electrolytes when hot. Nernst, therefore, heats the rods to make them conduct, and then heats them electrically, preserving a temperature which is within the limits that the material can bear without softening. This means that he can take the most refractory bodies supplied by the whole range of chemical research, and can heat them to a temperature short of their softening point, and can thus get an efficiency unknown to workers on the incandescent lamp. Such efficiency also means whiteness of light, so long as the efficiency is not too high. Thus the charter of the arc, being at a temperature of boiling carbon, gives a light that is unpleasantly blue.

The material is worked up into little white rods. Each rod is mounted on two platinum wires, a little paste made of refractory oxides being applied to the joints. The little rod with its two wires is then mounted on a holder which fits ordinary electric light fittings. As the rods fall in resistance as the temperature increases, after the manner of electrolytes, an increase of current produces a decrease of resistance. This tends to give some instability in running in parallel on supply circuits. This instability is corrected, as in an arc lamp, which has analogous properties, due to a different cause, by a series of resistance. The Nernst rod has therefore a resistance in series. This is made up of exceedingly fine wire, and for ordinary circuits amounts to 10 or 12 per cent. of the whole resistance of the lamp. The consumption including the resistance, is 1.5 watts per candle for large lamps, and 1.6 for small lights or low pressures. In small or low-pressure lamps the loss of heat at the ends is larger in proportion.

Such a lamp as I have described will not light up of itself, for the rod is an insulator when cold. The simplest way to start it is to warm it up with a match, or better with a small spirit lamp. Such a lamp as this is not only very cheap as regards first cost, but very economical in running. The life of rods, running at an efficiency of two-thirds of a candle per watt, including the resistance, is already more than 500 hours in good specimens. If the Nernst lamp advances as much in the first few years of its existence as the carbon lamp did between 1880 and 1882, it will soon be made so well that the rods last a lifetime. When the rod is worn out, a new rod with its wire mounts is all that is replaced. The whole lamp is not thrown away at all.

The method of lighting I have described, though it may be used in many cases, such as large public rooms, is really a savage mode of ignition, fit only for dealing with uncivilized commodities, such as gas and tobacco.

The small lamps and the lamps of medium size are in

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CONTENTS:

THE DARK LINES OF THE SPECTRUM.

A variety of new metals have been discovered by the aid of the spectroscope, an instrument of such delicacy that one two hundred millionth of a grain of sodium can be detected by it in a flame supposedly of pure origin. Several famous electricians and scientists in their experiments have dealt with the spectroscope sufficiently long to realize that by the aid of electricity much greater progress can be made. Bunsen, Kirchoff and Crookes have made discoveries in this peculiar field of research. The metals coesium and rubidium were discovered by Bunsen and Kirchoff and the metal thalium by Crookes.

It has been found that the spectrum of certain metals cannot be obtained except by the aid of a greater heat than that produced by a simple Bunsen burner. In order to effect a more rapid vaporization of refractory metals electric sparks have been passed between wires consisting of the very heavy metal whose spectrum is desired. Large spark coils are used for this purpose and the electric sparks produced by them have brought within the range of spectrum analysis many new metals whose existence would have been doubtful were it not for the employment of this unique method of analysis.

It has been further observed that the spectrum changes in character with the rise in temperature. For instance, chloride of lithium with various degrees of heat gives varying shades of colour in the spectrum, the flame of a Bunsen burner producing a peach colored line. The flame of hydrogen, much more intense, causes an orange line to make its appearance. The oxy-hydrogen flame creates a magnificent blue band of light which is greatly intensified in brilliancy of colour by the application of an arc light.

The interest attached to such experiments is of minor consequence in comparison with the immense value that success in given directions would bring. The spectroscope merely throws on the screen, in living colors, when analysed through its means, all known elements. The prevailing opinion, among minds of a high scientific order, that many of the so-called elements are still further reducable to more primary forms of matter can only be borne out by a test which the spectrum analysis can give.

In many respects the basis foundation of modern chemistry rests upon spectrum analysis which in itself would be incomplete if it were not for the application of electricity in so reducing and modifying various forms of matter that their classification can be made with absolute accuracy.

"The spectra of the permanent gases are best obtained by taking the electric spark of a Ruhmkorff coil, or Holtz apparatus, through glass tubes of a special construction, provided with electrodes of platinum and filled with the gas in question in a state of great attenuation, that is to say, in Geissler tubes. If the spark be passed through hydrogen the light emitted is bright red, and its spectrum consists of one bright red, one green and one blue line."

"If the electric discharge takes place between a compound gas or vapor the spectra are those of the elementary constituents of the gas. It seems as if at very intense temperatures chemical combination were impossible and oxygen and hydrogen, chlorine and the metals could co-exist in a separate form as though mechanically mixed with each other."

"The mining engineer is in many respects dependent upon spectrum analysis for detecting the various elemets which constitute any given sample of ore or mineral requiring analysis. To the electrician the value of the spectrum consists more in its being the means by which he hopes to arrive at the solution of certain important problems. The spectrum represents the common threshold leading from the department of optics into the higher branches of electricity. In the study of X rays, of Hertzian waves and of various other unique manifestations of light, including those beyond the range of physiological vision, the spectrum will play an important part as it represents the key board by whose means the great cause of nature may be thrilled by the hand of Man.

ELECTRICAL DISCHARGE IN GASES.

This interesting subject has been treated under the title of "The Discharge of Electricity Through Gases," by Prof. Thomson. The original arrangement of this volume will strike the reader as being unique. The departments are: "The Discharge of Electricity Through Gases, Photo-Electric Effects, and Cathode Rays."

The importance of knowing how electricity passes through gases and of making a study of the phenomena attendent upon its passage has impressed the technical as well as the lay reader. We are glad to see that consideration is given to the subject of Roentgen rays in such a manner that various peculiarities characteristic of them are given place and attention. The conducting power of gas when exposed to the influence of X rays points out at least a lesson which may lead, in the future, to statements still more remarkable from many other quasi scientists whose development of this idea may assume some strange form.

In a criticism by Ernest Merritt, the following statement occurs: "Practically all of the more reliable experiments are now seen to support the view that the discharge of an electrified body by the Roentgen rays is due to the fact, that the gas surrounding the body is made a conductor by the action of these rays."

practice started by a heating resistance. This is arranged close to the rod, and in shunt to it. As soon as the rod is hot enough to conduct, its current works a tiny cut-out in the resistance circuit. In large lamps the heating system is a little more elaborate, as the resistance arrangement is arranged as a sort of hood which covers the rod. As soon as the rod conducts, not only is the resistance circuit broken, but the electromagnet lifts the little hood clear off the rod. In all these forms, the rod and its mounting are replaceable without interfering with the rest of the lamp.

We now have to consider the part the Nernst lamp is probably going to play in the near future.

Compared with the small incandescent lamps, as you deal with a material of much higher specific resistance, it is easy to give both small lights and high pressures. The question of lighting is exceedingly important, though it appears trifling at first sight. People are so accustomed to lamps being turned on from the door without any further trouble that they will generally object to having to light them with matches or spirit lamps, but there are many cases in which it will be quite satisfactory to have one lamp with an automatic lighter to show you the way into the room, the rest being lighted with matches or a spirit lamp as needed. There will be, however, a considerable opening for the cheap, small-power, high-efficiency lamp, and the disadvantage as to lighting is small in such cases as cafes, restaurants, churches, hotels, railway stations, and, in short, in most public rooms is small.

Coming now to the next size—that is to say, lamps of 20 c.p. to 200 c.p., and even small lamps in which it is worth while to have automatic ignition—the first cost of such lamps will be higher than the first cost of incandescents, but as the rod itself has alone to be replaced, that is a matter of very slight importance. This size of Nernst lamp has, further, every chance of completely ousting the carbon incandescent on the score of cheapness as to renewals, higher efficiency, better colored light, and perhaps, more especially high pressure. Once the Nernst lamp becomes so general that systems of distribution are laid out to suit it, instead of to suit the carbon lamp, the carbon lamp is practically "out of the running." It must be remembered that the Nernst can compete with the carbon filament at any pressure that suits the filament, but the Nernst lamp can easily go right out of the depth of the filament and have the higher pressures to itself. It must be remembered that at present the cost of cables in a system of distribution is an exceedingly large item.

Turning now to the large lamps, they compete with the arc lamp in efficiency. Of course, the efficiency of the arc lamp is not a very definite quantity. The candle-power is generally determined by multiplying the current by 2 and adding zeros at discretion. All I can say is, that however many zeros the good nature of the maker may supply, a Nernst lamp taking the same power gives a better light. When carefully arranged on the photometer, the arc may be better in given directions, but a lot of light given in directions that you do not want is not the same as the same light distributed with a uniform spherical emission. The arc lamps shown here will give the audience a good idea of the relative values. The Nernst gives a pleasanter and, of course, a perfectly steady light. Coming to costs, the Nernst will be very much cheaper in first cost, but enormously cheaper in maintenance. It also goes quite away from the arc as to the pressures. There is no trouble, for instance, in making large lamps to work in parallel at 500 volts and by using double rods at 1,000 volts. This puts an entirely new development of electric lighting in the hands of the engineer.

There is one point I have said but little about yet. The incandescent lamp which is still with us gives trouble not only because of the low pressure it needs, but also because it demands that the pressure shall be kept uniform. It seems quite possible that the Nernst lamp may be made to stand a much greater variation of pressure than the filaments. If this proves true it means an enormous difference in the designing of distribution mains. I do not like to say much about this yet as the invention is too young, and too little time has been available to make much certain progress in that direction. Results are promising, but it is best not to be sanguine.

It is difficult to discuss an invention like this without being carried away with enthusiasm. I feel, however, that I have but feebly shown forth the probable future of what seems to me the greatest invention in electric lighting that we have seen for many years. Still, I am sure I have not been too sanguine.

ELECTRICITY FOR MARINE PURPOSES.

The electric launch and submarine vessel have received considerable attention of late due to our late war with Spain. It is very likely that certain changes in naval warfare will owe their origin to the free application of electricity. This will be true more in relation to the submarine vessel than the electric launch. The electric

Submarine Vessel Operated by Gas and Electricity.

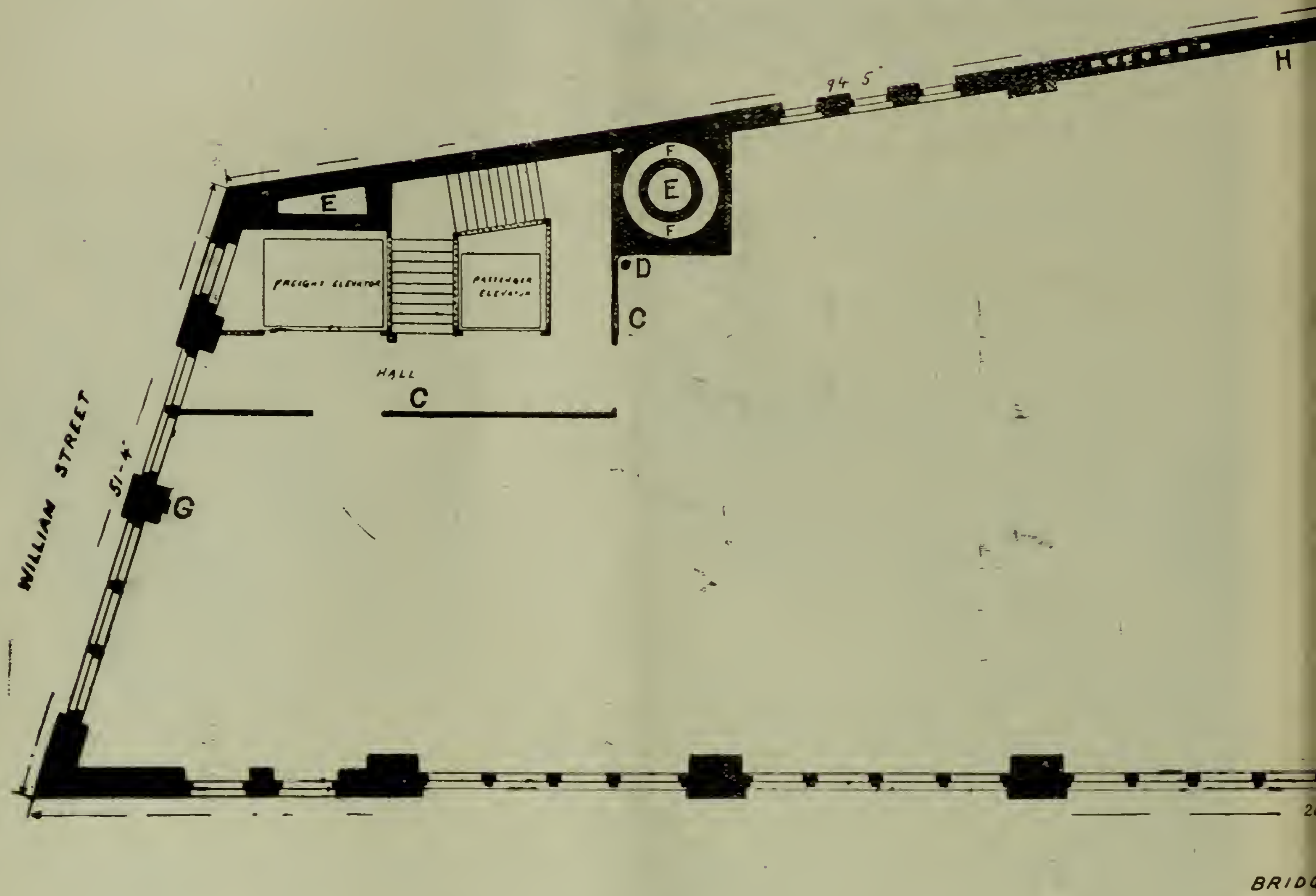
torpedo boat, of the style of the Holland, when under water suffers from several disadvantages of which the worst is the opacity of the water. The statements of Jules Verne are incorrect as far as its transparency is concerned even when a powerful light is projected into it. A quickly moving electric launch operating entirely upon the surface may therefore possess advantages in actual

Model Electric Launch Made for the Czar of Russia.

warfare which the torpedo boat does not. If constructed so as to move at the rate of thirty-five or forty miles an hour, it would be hard to hit and the large vessel it was attacking would labor under the same distress if a torpedo is planted near it in this manner as when attacked from below. The moral effect of a torpedo boat upon a warship is certainly prodigious, but a launch darting upon the surface of the water with the speed of the wind could risk bombardment almost as safely. The advanage being that those on board could see where they were going to and at least die in daylight.

METROPOLITAN REALTY BUILDING,

214, 216, 218 William St. and 18-20 Rose St.



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TRANSMISSION OF POWER.

THE LEAST TOTAL FIRST COST OF A TRANSMISSION PLANT.

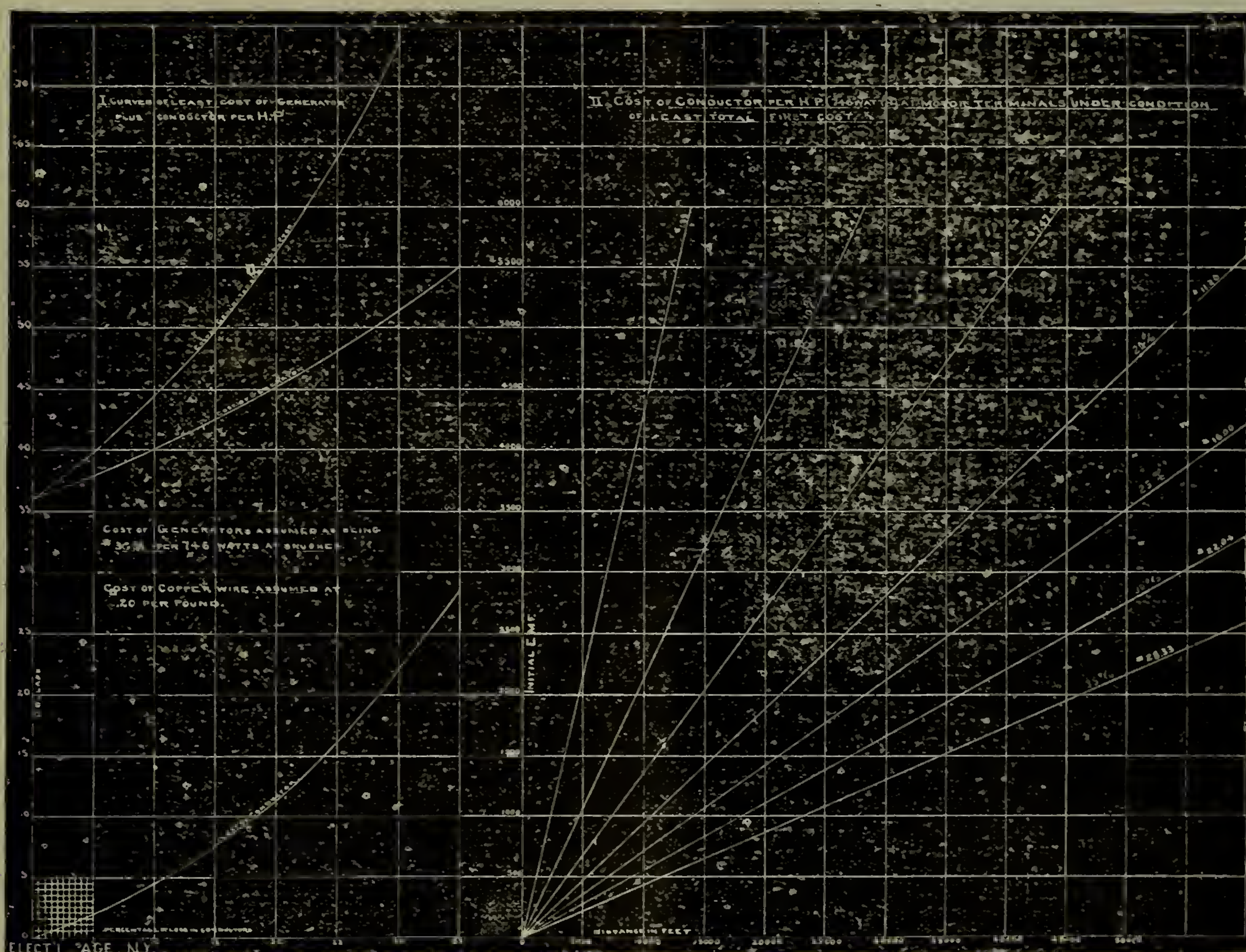
The conditions governing the investment of capital when employed for the erection of a power plant, are climatic and geological. By this we mean that it would cost more to transmit power in a rainy country than a dry country, other things being equal. It can be further understood, that the erection of poles, and the laying of lines in countries where the ground is full of undulations would be a serious objection to a minimum of expense.

Power producers investigating the advantages of electrical power transmission will, in most cases, be satisfied to calculate the conditions for the minimum initial cost of the plant, leaving the exact determination of the cost of one horse-power, and the price at which they can profitably rent power to future development.

Frank J. Sprague, in speaking of an ideal transmission plant, states as follows: "The cost of a plant of this character can be divided into five parts. That of the motors, the conductors, the line erection, the dynamos and the power plant, whether water or steam. I will assume that the cost of the dynamos and motors is the same per horse-power or other unit, no matter what the electro motive force used may be. While this is not strictly true for all practical purposes, for large units and speaking from the commercial standpoint it can be so assumed. This being the case for any given power the cost of the motor is a constant, independent of the potential used.

With any given motor potential the greater the loss on the line, the less the cost of the conductros, but the greater the cost of the generators. On the other hand, the less the loss on the line the greater its cost, but the less the cost of the generating plant. It follows then that the least cost to the contractor is determined when the variation in the cost of the generator is equal to that in the cost in the line."

The diagram, which is self explanatory will doubtless enable the reader to arrive at some very interesting conclusions regarding the cost of line, generators, etc.



The Least Cost of Generators and Conductors.

AUTO-MOBILES.

THE MOTOR VEHICLE IN COMMERCIAL OPERATION.*

By G. Herbert Condict.

We are told that about 2500 years ago there lived a prophet, Ezekiel, who had a vision, and in this vision he saw some marvelous wheels. Without attempting to determine what was meant by the vision let us appropriate his statement regarding those wheels, as a text for this talk on the horseless vehicle. "For the spirit of the living creature was in the wheels." What an apt and concise description of the vehicle which, having discarded the "living creature" the horse," still moves on with his "spirit."

We are but just entering a new era in the art of transportation; as the advent of the electric car brought a revolution in local rail transportation, so the advent of the road vehicle which goes without horses, has commenced its triumphant campaign. Having come out victorious on the rail, the horseless forces are now gathering for the battle on the road. Even the Tammany Brave is putting on his war paint and is thirsting for the fray. The "trolley buggy" is "the thing" and the "hay-motor" "sees his finish."

As we all know, the use of the horseless vehicle abroad far surpasses the little that has been accomplished in this country, but oil and steam furnish the power almost exclusively and the electrics are in the meagre minority. With oil, gas and steam motors counted by the thousands, the electric foots up only by tens.

Far different is the case on this side of the ocean. Oil, gas and steam vehicles are few in number and there are

*Meeting of the N. Y. Electrical Society, Feb. 14, 1899.

not 150 electrics in actual service. Yet there is no room for despair for the Yankee rig, especially the electric, has already made an enviable reputation for itself and promises to distance all comers.

Only two or three remarks can be made here regarding the relative merits of the various forms of power used to make the wheels go round.

Undoubtedly there will be discovered a place for each system in which peculiar adaption to local conditions will render competition in that particular field, by less favored rivals, improbable.

I am not referring here to the light pleasure vehicles engineered by the owner who, as a general proposition, cares comparatively little what the cost of operation amounts to, but to that business affair that is to carry you and your goods to and fro in all conditions of weather,—rain, shine, snow and sleet,—within the narrow confines of the city streets. It was the raging blizzards of the present season that served more than anything else to bring into prominence the motor vehicle, which ventured in where horses feared to tread, and, in spite of all prophecies to the contrary, got out again with ease. It is in such service that the future of the automobile is to be filled with glory.

City transportation must be carried on with as little interference to the rights and comforts of others as possible. No motor depending in any degree on any of the products of petroleum is free from disagreeable odor. The principal streets of Paris, where the oil motor holds sway, are filled with the offensive odor so inseparable from the oil well districts of Pennsylvania. A trail of unsightly vapor accompanies the onward march of the steam motor, particularly in cold weather. Vibration produced by the reciprocating parts of many motors is very disagreeable, especially when they are operated slowly and stopped and started frequently, as in municipal service. But the electric, noiseless, odorless, vaporless, operating without jar or vibration, surely it has found a field in which its virtues can shine without fear of the dimming shadow of a close rival.

In the crowded narrow streets of the city it excels in all that goes to make up a mode of transportation, void of offence, but some one says, that the electric is a great, heavy, cumbersome thing. Yes, it is. That is the fault of our storage battery friends. The battery is the "champion heavyweight" of the electrical fraternity. It is a case of full weight for the money, when you buy one. But no one buys a motor vehicle by the pound, and it does not make any particular difference what the weight is if the thing performs successfully and economically the work for which it was fashioned. In this connection it is often necesary to remind the critic that in comparing the horse vehicles and the motor vehicles the weight of the horse or horses must be included in the weight of the former. Of course, we all know that the moving of weight calls for more expenditure of energy, and unless this expenditure is offset in some other direction, the system having the burden must fail. If the heavy vehicle can transport a passenger or a ton of pay load from one point to another in a more acceptable manner than a light vehicle, the former does the business. At this time it is impossible to obtain reliable data for the comparison of cost of operation of the various systems now on the market. Figures made up from absurdly inadequate data have been published from time to time, but so far nothing of much value is known on this point. By "cost of operation" I mean the total expenditure in cash for fuel, oil, attendance, repairs and replacements of parts for a period of sufficient length to secure a fair average. Such observation should extend over, at the very least, a year, and there has been no commercial operation of any magnitude in this country, or any other for any length of time. In Europe in spite of the fact that thousands of automobiles are used for pleasure riding, there is to-day only one cab station in actual operation and a few light delivery wagons with here and there a lumbering steam truck, or a fear inspiring omnibus. In this country a few cabs operated from one little station and perhaps a dozen delivery wagons. In spite of the almost unqualified success of these few vehicles we know them to be far from perfect, and, more than that, we know how to make many most important improvements. The most unexpected demand during the last few weeks for the electric cab in this city has given it a test which years of ordinary intermittent operation could not furnish. Its faults have glared out prominently, its virtues have shown in a brilliant manner, and, as one of our daily "contemporaries" says, "In all its picturesque ugliness, the automobile is a boon and a blessing. . . . We not only give it our respect, but our admiration. . . . The gentle horse has had his day." Having covered over 250,000 miles of actual and commercial service, the vehicle has proved itself no longer a toy to be played with by the wealthy, but a practical thing, which is to come to the aid of the dwellers in our great cities who are anxiously beholding the vast congestion of traffic in the streets and wondering what is to become of it in the future. The modern Rip Van Winkle goes to sleep for much less than twenty years, and when he awakes, what does he behold? The streets of the city are clean; no rails cut up the smooth surface, no horse or any other beast is here, they are prohibited within the city limits. The pedestrian wends his way along the sidewalks elevated to the second story and bridges over the street, while below the agile electric bridges over the street, while below the agile electric darts at good speed back and forth on its noiseless, easy riding pneumatic tires, carrying all manner of humanity and its goods and chattels, and delivering them, not at the curbstone, but at the doorstep. The "living creature" has departed but his "spirit is in the wheels." The elevated train, the cable and the trolley car have disappeared, but far below the surface glides the electrical local and express in light and well-ventilated subways. The streets, made wider by the absence of sidewalks on the same level, allow a free movement of vehicular traffic, and the second story stores are free from the dirt and turmoil now so overpowering.

And now for a moment let us consider this electric vehicle station; the first in the world in which the batteries are transferred by mechanical means entirely, the whole operation being under the control of one man standing on the platform of the electric crane.

The men who organized the company looked at the crude and inefficient apparatus which was at their disposal and saw in it the possibilities of a great industry. They decided to put sufficient capital at work to develop their ideas, and the present success of electric cabs bears abundant testimony to the wisdom of their decision. This station was equipped with the most approved battery-handling apparatus then obtainable, and no expense was saved in procuring the very latest improvements in all of the various parts which go to make up a vehicle which could be depended on to do the work required of it. The supply is so absurdly inadequate to fill the demand that operation is carried forward under great disadvantages, considering the many component parts that are altogether incomplete and experimental. It has been impossible to make accurate tests of the efficiencies of motors, batteries, gearing, bearings, etc., although such data is now being obtained. There is still much to be desired, and in future equipments most material improvements will be made.

Outside of the consideration of large weight in proportion to power delivered, the battery has been giving excellent service. Up to the present time there has been practically no expense for maintenance, and the old-time troubles of buckling, short circuiting, sulphating, disintegrating are as yet entirely absent.

The tire situation is at present the absorbing subject of our day thoughts and night dreams. Were the streets in

this great metropolis paved in an up-to-date manner, there would be comparatively little cause for anxiety on this score, but with the antiquated and despicable cobble, the case is far different. Over twenty separate and distinct types of tires have been tried or are to be tried in the near future, and others will probably follow. Solid, single and double tube, pneumatic, cushion, clincher, sectional, protected and unprotected have all had or are to have a trial. Their faults are many, their virtues few, and we are still in the search. We have heard of some eminent authorities in the motor vehicle field, who say that the solid is the only tire. They are rendering judgment without full knowledge of the facts and from a purely local standpoint. They are evidently not acquainted with the streets of Manhattan. A very satisfactory tire for broughams is that of rear pneumatic and front solids.

The wheels also require most serious consideration. The severe strains unavoidable in crossing railroad tracks and other inequalities and running up against curbstones speedily put out of service even the most substantial constructions. Everything from the light and airy bicycle wheel construction to the dishpan wheels, now so familiar on our streets, have been tried, and still there are more to follow. I mention these few items simply to indicate some of the most important and particular directions in which the work is progressing.

I have been asked by our worthy secretary to say something about the "auto-truck," that mysterious being fed on wind, and on the breath of "bulls and bears" and "lambs." The daily papers have been full of him lately, and why should I weary you with a repetition of how the poor truckman is to be benefited by the advent of this new beast, or how the world in general is to receive a blessing when he breathes. "This is the age of miracles," and "all things come to him who waits." We have been waiting a long time, and now possibly even compressed air will come to us on wheels.

MISCELLANEOUS.

STRAY CURRENTS.

ELECTRIC LIGHTING AT THE GREATER AMERICAN EXPOSITION.

The electrical illuminations in the grand court of the Greater American Exposition of 1899 at Omaha will excel in magnificence any display heretofore made by American Expositions.

THE JUNGFRAU ELECTRIC RAILWAY.

The electric railway in process of construction upon the Jungfrau will be operated by overhead wires with a line of cogs imbedded in the roadway to ensure safety. 7,000 volts will be the tension of the wires, the current being generated in the valley of Sauterbrum.—Scientific American.

ELECTRIC POWER AT KALGOORLIE.

A despatch from Perth (W.A.) to the Financial News says that the managers of some of the leading mines on the Kalgoorlie field are urging their companies to combine in erecting a central electric power station for supplying electric power to the various mines for stamping, hoisting, winding, and pumping purposes, thus following the action taken for the first time in Australia by the English companies engaged in working the deep leads in Victoria.

TYPE PRINTING TELEGRAPH.

The London Electrician contains an illustrated description of the improved form of the Higgins type-printing telegraph. It is claimed that a speed of twenty-five to thirty words per minute is possible, and that the manipulation is easy. Instruments have been working in London on a resistance of 1,500 ohms; also between London and Folkestone, a distance of sixty miles; satisfactory tests were also made by the British post office.

LIGHTING THE PYRAMIDS WITH ELECTRICITY.

Engineering News refers to a plan now under consideration by the British Government for the lighting of the pyramids by electricity, and the installation of an electric power transmission plant of 25,000 horse-power.

The plan involves the erection of a power generating plant at the Assouan Falls on the river Nile, and its transmission over a distance of 100 miles through the cotton-growing districts, where, it is thought, the provision of cheap power from this source, will permit the building of cotton factories. Part of the scheme contemplates the lighting, from this source, of the interior corridors of the pyramids, and also the operation of pumping machinery for irrigating large areas of desert lands along the Nile. It is also stated by the News, that an American company is likely to receive the contract for this work.

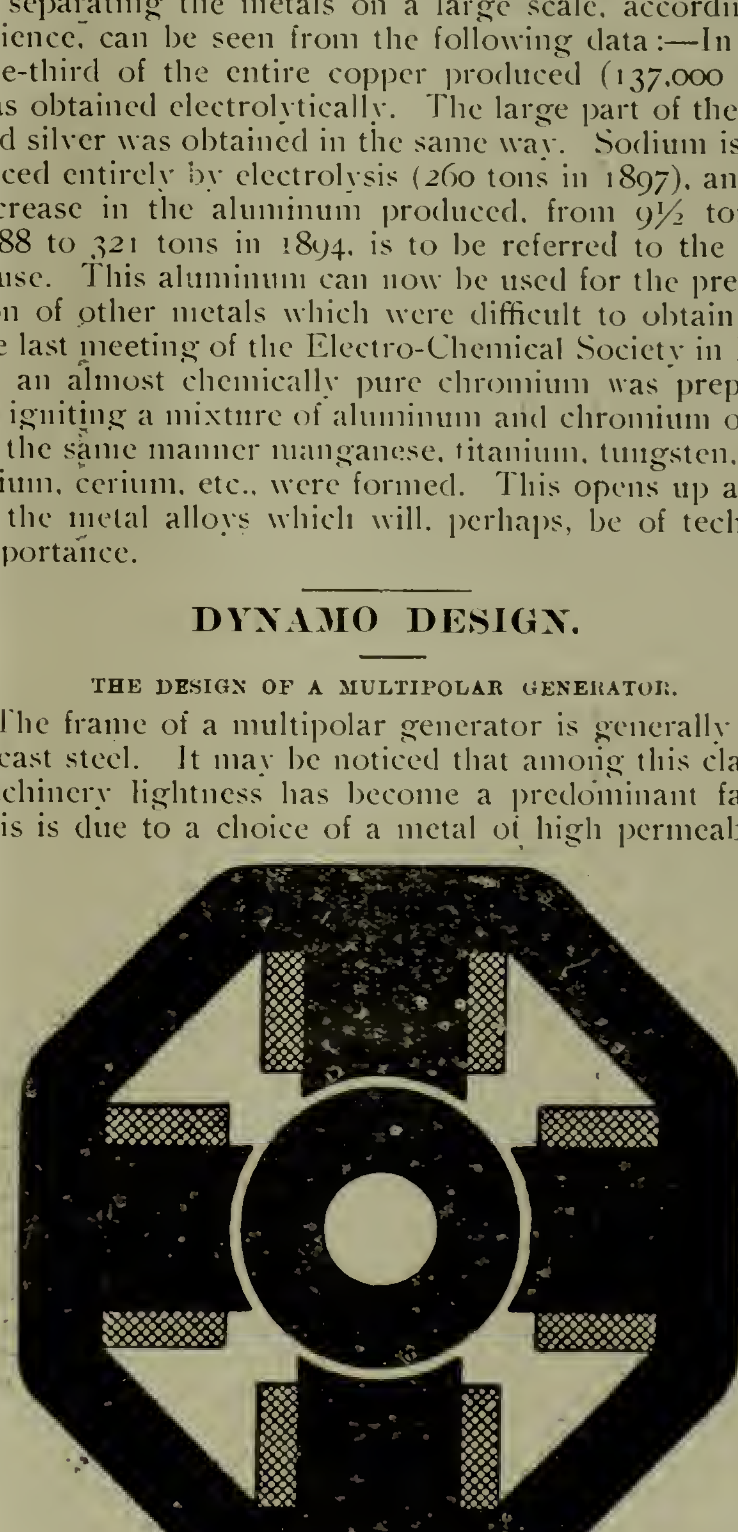
ELECTRICITY IN SEPARATING ORES.

What has been accomplished by the use of electricity in separating the metals on a large scale, according to Science, can be seen from the following data:—In 1897 one-third of the entire copper produced (137,000 tons) was obtained electrolytically. The large part of the gold and silver was obtained in the same way. Sodium is produced entirely by electrolysis (260 tons in 1897), and the increase in the aluminum produced, from 9½ tons in 1888 to 321 tons in 1894, is to be referred to the same cause. This aluminum can now be used for the preparation of other metals which were difficult to obtain. At the last meeting of the Electro-Chemical Society in Leipsic an almost chemically pure chromium was prepared, by igniting a mixture of aluminum and chromium oxide. In the same manner manganese, titanium, tungsten, vanadium, cerium, etc., were formed. This opens up a field in the metal alloys which will, perhaps, be of technical importance.

DYNAMO DESIGN.

THE DESIGN OF A MULTIPOLAR GENERATOR.

The frame of a multipolar generator is generally built of cast steel. It may be noticed that among this class of machinery lightness has become a predominant factor. This is due to a choice of a metal of high permeability,



FRAME WORK OF MULTIPOLAR GENERATOR.

and the use of more electro motive force inducing elements, that is to say, poles and inductors on the armature. A multipolar dynamo is merely two or more generators in conjunction possessing a common armature, commutator and field. It is possible to connect up the armature so as to either give the volume of current proceeding from two or more machines or a total of pressure from the same number. The armature is therefore,

wound in two ways. With wave winding for the total pressure or with lap winding for the total current. The magnetic field, each pole of which acts co-operatively in a multipolar dynamo, gives us low speed, large radiating surface for the armature and a superior mechanical construction to that involved in the use of the bi-polar dynamo. For direct connection a multiplier generator is superior to the same weight of any other type of dynamo for equal output.

ELECTRO THERAPEUTICS.

PHYSIOLOGY AND THERAPEUTICS OF THE SINUSOIDAL CURRENT.

There are several physical peculiarities possessed by the sinusoidal current which help to make its action on the body different from that of other forms of current. As has been seen from the foregoing description, the increase and decrease of potential in this form of current is gradual and uniform, and never abrupt nor sudden in its change. It is no doubt to this feature of the current that its peculiar action on the sensory and motor nerves is mainly due. The sensory and motor mechanism of the body is capable of adjusting itself to a considerable range of difference in external conditions without serious disturbance or discomfort, provided the change is not too sudden or violent. Even though there may be many periods of alternation of current per second and the electro-motive force be quite high, yet the action of nerve and muscle is still capable of responding to such vibrations without disagreeable reaction, provided the change in strength is gradual. The number of alternations per second, the degree of electo-motive force and the quality of the current are, no doubt, each important factors in determining the physiological and therapeutic effects of this current; but these are not so peculiar to it as is this feature of uniformity in change. The effect of this special feature of the sinusoidal current is to lessen the disagreeable effects of electric excitations both on the sensory and motor mechanism. The same amount of stimulation to muscular action can be aroused as by any other equally powerful means, without the accompanying pain and consequently without the shrinking and apprehensiveness on the part of the patient which other forms of excitation arouse. In this lies the chief advantage of the sinusoidal current over the current derived from the secondary induction coil while in many other respects these currents are similar in action.

For exciting to vigorous action muscular tissue, therefore, whether it be the voluntary or involuntary variety of muscles, the sinusoidal is the current parexcellent. Such frequency of alternations can be used as will adapt the excitation to the requirements of the muscular structure. The comparative painlessness of the applications permits the use of greater electro-motive force and more current than can be used either from the induction coil or the primary battery, so that the physiological action of the muscles is more thoroughly aroused than by the use of either of these other forms. The more nearly the curve of current conforms to the sinusoidal the less will there be of effects resulting from polar action. Electrolysis and cataphoresis will be avoided and the changes brought about in the tissues to which the current is applied will be mainly those which are normal to their function; the effect of the current being to arouse that function to greater activity.

When we consider how many of the normal processes of the body, such as assimilation, circulation, secretion, exertion, locomotion, etc., depends directly upon muscular tone and vigor, it will be seen at a glance what a wide range of therapeutic application is possessed by this form of current in the field of muscular excitation alone. It has been highly spoken of by many competent electrotherapeutists as a means for improving the nutrition and growth of muscular tissue whenever it is failing from lack of proper excitation.

General muscular weakness, local paralysis or paresis, lack of intestinal peristalsis, vaginal and rectal prolapsus due in whole or in part to lack of muscular tone, and vasomotor debility are some of the conditions in which the form of current has proved especially beneficial.

It has been said that the sinusoidal current is remarkable for the little amount of sensory excitation it causes, and so permits powerful muscular contractions without discomfort. Further than this it serves to allay pain. It is as much if not more serviceable in this way than is the current derived from the secondary induction coil of many terms. Apostoli and others have borne strong testimony to the fact that the greatest success they have attained with this form of current has been in allaying the pains that occur in connection with the pelvic organs. The pains caused by uterine inflammation, pelvic cellulitis, ovaritis, salpingitis and congestion are quickly allayed by it. Neuralgic pains are relieved and those of spinal irritation. Marked effects on tissue metabolism have been noticed also as indicated by increased consumption of oxygen and more rapid elimination of carbon dioxide. These effects are in all probability secondary to and dependent upon the increased muscular activity and analgesic influence of the current.—(Bulletin Elect. Therap. Lab., Univ. Mich.)

ELECTRIC RAILWAYS.

ELECTRIC RAILWAYS IN GERMANY.

Mr. W. K. Anderson, the United States Consul at Hanover, Germany, writes as follows: I glean from the last number of the Electrotechnische Zeitung the following statistics:

Up to the end of the year 1891, the number of cities in the German Empire enjoying the advantages of electric street railways were three; up to the end of 1892, five; 1893, eleven; 1894, nineteen; 1895, thirty-two; 1896, forty-four; 1897, sixty-one; and on the 1st of September, 1898, no less than sixty-eight. In thirty-five other cities or districts, railways are in the course of construction or finally determined upon. The entire length of electric lines in operation in Germany on September 1, 1898, was 888 miles, and the total trackage was 1,205 miles. The number of motor cars was 3,190, and the number of trailers 2,128. The length of the new lines in course of construction or about to be begun at that date was 677 miles, and their total trackage 830 miles.

Most of the large industrial cities in Westphalia and the Rhine Province are connected by a network of electric roads, which serve not only for passengers, but for freight traffic.

The electric street railway of Hanover was built under the supervision and direction of an American from Philadelphia, and was opened for business on May 1, 1892. It was one of the first electric lines inaugurated in Germany, and is now one of the best systems in existence. The cars are modeled after our American ones, and the tracks are of heavy steel, laid on a substantial foundation of concrete. The fare for a course of, say, 2 miles within the city limits is 10 pfennigs, or less than 2½ cents of our money. Universal transfers are granted. The speed is about 8 miles per hour, and the cars run smoothly and with but little noise. Within the mile circuit and upon some of the principal streets extending to the city limits, the cars are run on the accumulator system; but when the outskirts are reached, the accumulators are released from service and the cars are run by overhead trolley. The lines extend, on almost every road, miles into the surrounding country. The trackage of the Hanover Electric Railway now amounts to over 105 miles. The equipment consists of 41 overhead-trolley cars, 161 accumulator and

trolley cars combined, 167 trailers, 20 locomotives, 4 sprinklers, and 24 freight cars. There are six power stations, four of which furnish, in addition to power for the cars, electric light for streets and roads. The motor cars are from 17 to 34 horsepower, and the locomotives 50 horsepower.

PRODUCTS OF THE ELECTRIC FURNACE.

CALCIUM CARBIDE AND ITS ANALYSIS.

The production of calcium carbide in the electric furnace has become an important industry, and the article is now being placed upon the market in large quantities. Nevertheless, the preparation of tons of carbide, as easy as it may appear at first glance, has offered certain difficulties. The preparation of the mixture, the nature of the carbon and lime, the construction of the furnace, and the application of the electric current, all these were problems that had to be studied, but which, for the greater part, are now solved. The proper development and utilization of the gas obtained from the carbide are yet objects of much scientific investigation, but it can be stated without fear of contention that the acetylene industry has passed the state of infancy. The "Echo des Arts et Manufactures" recently published analyses of calcium carbide as met with in commerce.

Theoretically, one kilo of carbide should furnish 349 liters of acetylene gas, but in decomposing a number of finely crystallized samples the volume of gas obtained from one kilo of carbide varied from 318.77 down to 292.81.

If carbide be porous and dirty looking, its gas contents are still lower, and such samples gave values as low as 228.60.

Without dwelling on the impurities of the gas, a question that has been fully discussed, it will be sufficient to mention that some samples contained considerable amounts of ammonia. In several samples hydrogen phosphide was also noted, while some were exempt.

Some facts regarding the preparation of the lime-carbon mixture may be gained from a study of the insoluble residue left by the carbide after its decomposition. After washing and drying, the residue on microscopic examination will be found to consist chiefly of silicated carbon, calcium and iron white spots that are rich in lime, and sometimes a little sulphureted calcium and graphite.

When treated with 10 per cent. hydrochloric acid the residue loses slightly in weight, and in the solution there is found iron, lime and a small quantity of alumina and phosphorus. The silicated carbon and graphite remain always intact, while sulphureted calcium has disappeared. By treatment with concentrated acid lime, iron and silica are dissolved. There is, however, no relation between the value in insoluble matter and the contents of gas in the carbide.

Silicated carbon in the residue is easily recognizable by means of the microscope, and its hexagonal crystals, either green or blue, are always its reliable characteristics. It can easily be separated from other substances by reason of its high specific gravity (3.12) and its refractory properties. By attacking the residue alternately with boiling sulphuric acid and hydrofluoric acid, there is finally nothing left but silicated carbon and graphite. By means of bromoform of 2.9 gravity, these two bodies are easily separated. Silica is found in the residue sometimes in the state of silicate of calcium.

Sulphur occurs in the residue of calcium carbide as either sulphuret of lime or alumina. Iron is present in state of silicate or carbo-silicate. Its contents are variable, and depend chiefly on the purity of the carbon employed in the mixture.

Phosphorus is the most troublesome impurity in the carbide. The larger part occurs as phosphuret of calcium, and is decomposed by water, thus passing into the gas. The smaller part is present in the shape of small spheres of metallic aspect, and containing iron and silica.

Carbon was found in several samples in the form of graphite, and in the shape of more or less irregular, sometimes hexagonal lamellae. Silica and calcium are obstinately retained by this graphite.—"American Manufacturer."

AMONG THE SOCIETIES.

American Institute of Electrical Engineers.

The regulary monthly meeting of the Institute was held at 12 West Thirty-first street, New York, on Wednesday evening, Feb. 15, a week earlier in the month than usual on account of the regular date falling upon Washington's birthday.

A paper was read by Robert A. McLloyd, entitled "Storage Batteries and Railway Power Stations." It was discussed by Messrs. Hill, Mailloux, Birdsall, Coho, Smith, Holmes, Henshaw, Bijur and others.

A meeting of Western members was also held on the same evening at the rooms of the Technical Club, 228 South Clark St., Chicago, where Mr. Lloyd's paper was also read and discussed.

At the meeting of the Executive Committee in the afternoon the following associate members were elected: Frank Pierce Adams, 171 N. El Dorado St., Stockton, Cal.; Julius Le Roy Adams, Manchester, Conn.; Paul K. Brown, Union Street, Petersburg, Russia; N. M. Currie, Conneaut, Ohio; John Sturges Codman, 57 Marlborough St., Boston, Mass; Clifford E. Dunn, residence, 12-a Monroe St., Brooklyn, N. Y.; Charles William Hutton, Sacramento, Cal.; Edmund Oscar Schweitzer, 196 Oakdale avenue, Chicago, Ill.; Arthur E. Truesdell, 433 Fourth avenue, Newark, N. J.; Marcus B. Waterman, 177 Lefferts Place, Brooklyn, N. Y.; John Shreeve Wise, Jr., 2023 Mt. Vernon St., Philadelphia, Pa.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

Total Amount of Electrical Exports for Week Ending Feb. 14, 1899, $59.516.00.

New York, N. Y., Feb. 14, 1899.—The following exports of Electrical Material, etc., are from the port of New York for the week, ending this date:—

Antwerp—Seventeen cases electrical material, $894.

Argentine Republic—Seventy-eight packages electrical machinery, $4,819; 74 packages electrical material, $3,281; 1 case electrotypes, $245.

British West Indies—One hundred and twenty-three packages electrical material, $5,989.

British Australia—Four cases electrical material, $30.

Berlin—Thirty-five packages electrical machinery, $6,470; 10 cases electrical material, $200.

Bremen—One case electros, $10.

Cuba—Twenty-seven packages electrical material, $808.

Central America—Eight packages electrical material, $158.

Chili—Thirteen packages electrical material, $80; 1 case electrical machinery, $35.

Ecuador—Twelve packages electrical material, $550.

Glasgow—Six cases electrical material, $220.

Havre—Thirty-four cases electrical material, $1,356; 1 case electros, $140.

Hamburg—One hundred and seventeen packages electrical machinery, $22,096. 58 packages electrical material, $4,979.

Liverpool—Seven cases electrical material, $365.

London—One hundred and twenty-eight cases electrical material, $4,561.

Mexico—Forty packages electrical material, $1,254.

NEW INCORPORATIONS.

Portland, Me.—The American Automobile Co., has been incorporated by Daniel McKives, Julian A. Chase, Frank Mossberg, Edward K. Milliken, and A. J. Desmond; for the purpose of carrying on the business and license of manufacturing, buying, selling, using and dealing in motor wagons, electrical machinery, electrical goods and appliances, etc. Capital stock, $250,000.

St. Regis Falls, N. Y.—St. Regis Falls Electric Light Co., has been incorporated by H. E. O'Neil, W. T. O'Neil, and W. B. Babcock. Capital stock, $2,000.

Highland, Ill.—Highland Electric Co., has been incorporated by W. M. Rickert, N. P. Rickert, and G. N. Sitkin. Capital stock, $15,000.

Richmond, Va.—Winston Electric Construction Co., has been incorporated C. R. Winston, H. Montague, P. Winston, J. N. Carter, and G. H. Winston. Capital stock, $5,000.

San Francisco, Cal.—The Standard Electric Co., has been incorporated; John S. Drum, F. H. Dam, M. F. Vandall, B. W. Harrison, and E. J. Baumberger; general electric light and power business. Capital stock, $5,000,000.

Cambridge, Ohio.—The Benbow Electric Co. has been incorporated by William C. Benhow, Nathan B. Barber, James A. Weyer, H. O. Barber, and Charles Mart; to buy and sell electric supplies and equip electrical plants. Capital stock, $5,000.

Dublin, N. H.—Dublin Electric Co., has been incorporated by Chas. F. Appleton, Chas. J. Ellis, Geo. W. Gleason, Henry D. Larned, and Arthur O. Mason; generate and sell electricity. Capital stock, $5,000.

TELEPHONE CALLS.

Du Quoin, Ill.—Du Quoin Telephone Co., has been incorporated by R. H. Youngblood, F. H. Stamper, and H. H. Oustatt; telephone exchange. Capital stock, $16,000.

Richmond, Ind.—The Richmond Home Telegraph Co., has been incorporated by J. M. Lowtz, P. J. Freeman, J. W. Moore, W. Parry, and A. C. Lindemeth. Capital stock, $100,000.

Kansas City, Mo.—Independent Telephone Co., has been incorporated by G. F. Putnam, R. H. Keith, C Campbell, G. T. Stockman, and E. O. Moffat. Capital stock, $300,000.

West Leyden, N. Y.—Constableville and West Leyden Telephone Co., has been incorporated by Benedict Gantner, S. C. Capron, Ione Capron, Frederick Myers, Elizabeth Myers, and John J. Douser; to operate a telephone system. Capital stock, $3,000.

STREET RAILWY NEWS.

South Bend, Ind.—A franchise has been granted to the local street railway to build a line to Niles, Mich.

Adrian, Mich.—The Jackson & Adrian Electric Road has been granted a franchise.

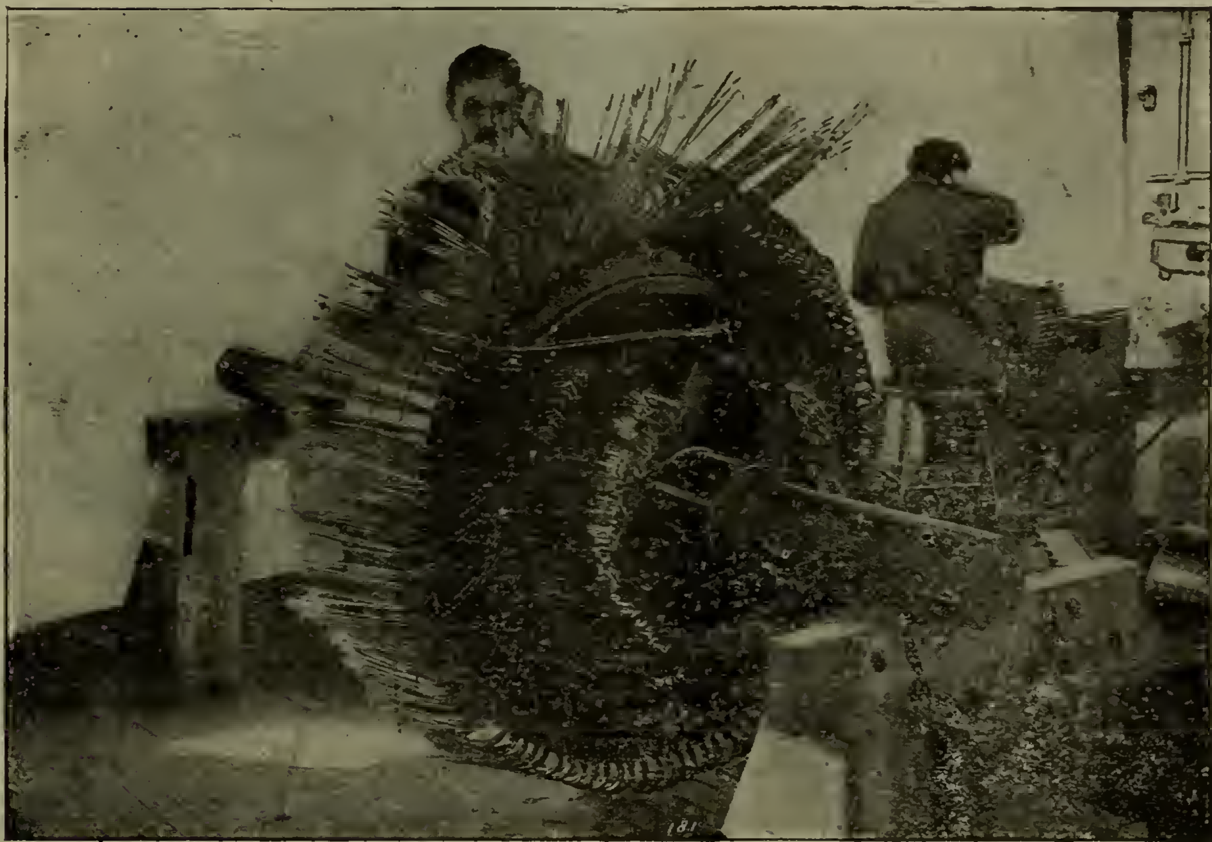
POSSIBLE INSTALLATIONS.

Dover, Del.—A complete electric light plant has been established.

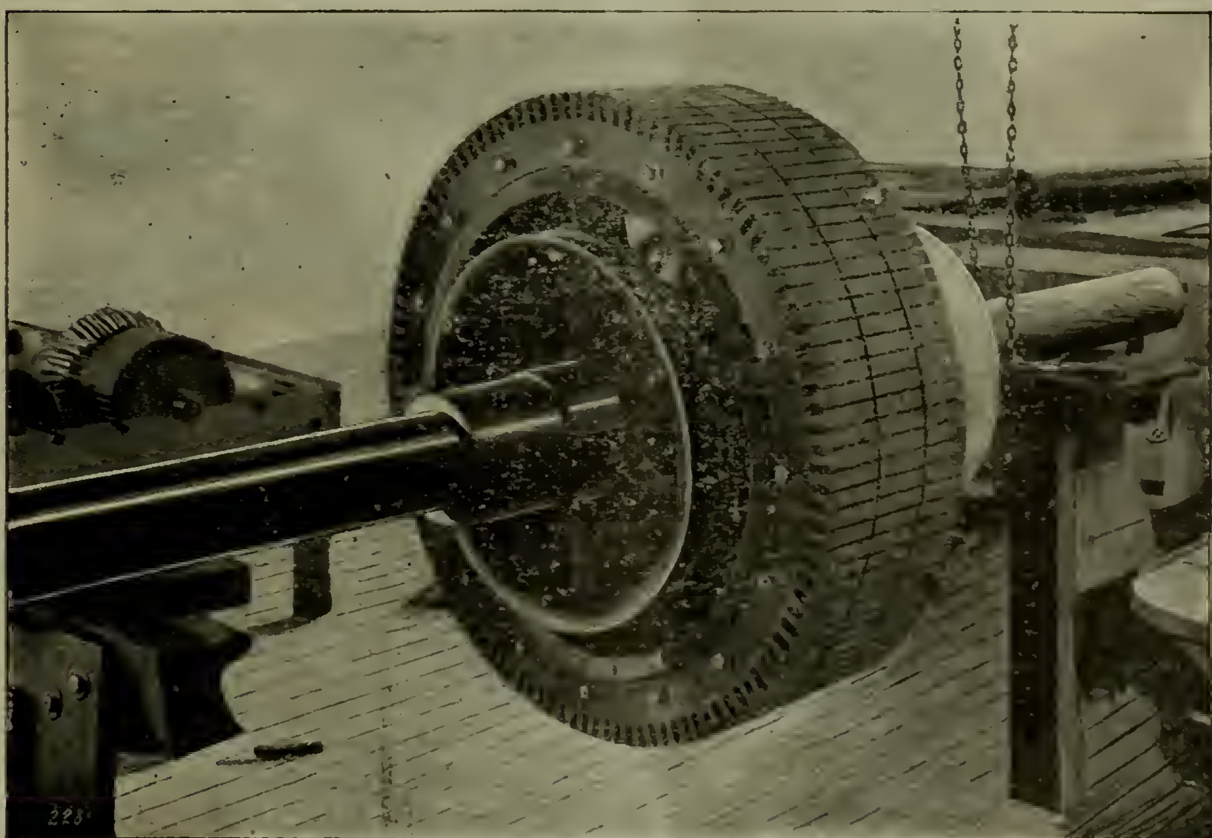
The Electrical Age.

VOL. XXIII—No. 9 NEW YORK, MARCH 4, 1899 WHOLE No. 616

DYNAMO DESIGN.



C.-W. Armature Partially Wound.



C.-W. Armature Core.

SMOOTH CORE AND TOOTHED ARMATURES AND BI-POLAR AND MULTI-POLAR MACHINES

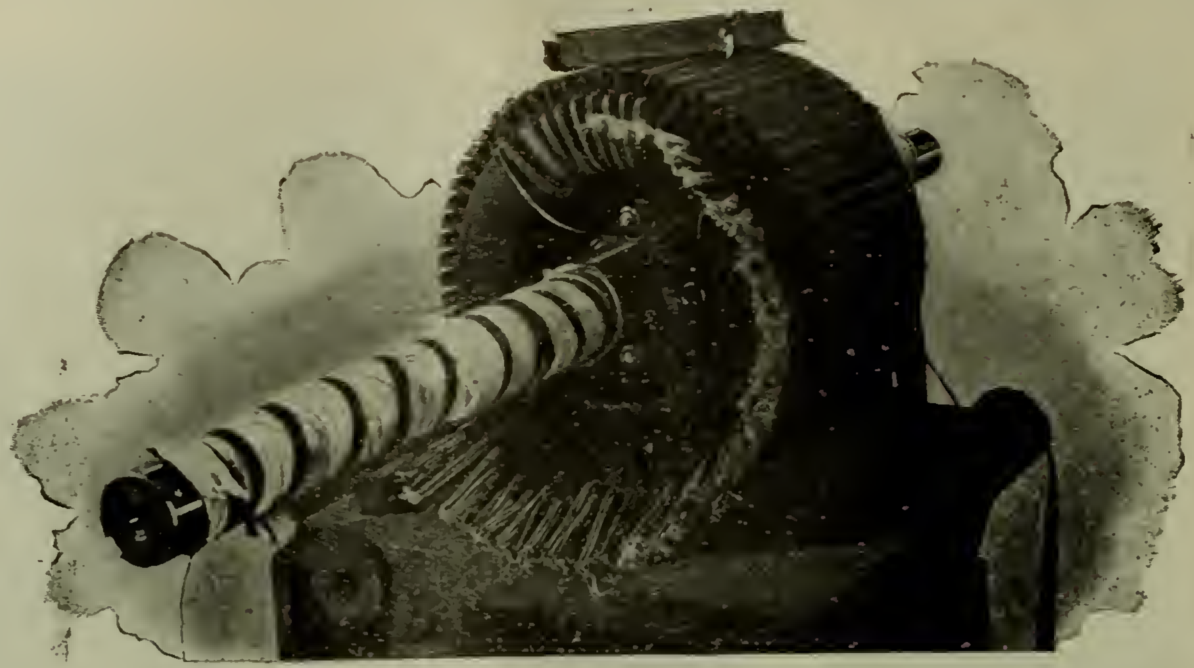
The difference between a smooth core and toothed armature is that the second means a saving of copper and affords that protection to conductors which could not be guaranteed in the older type. The advantages of easily removable and interchangeable coils on the armature have been so great that the departures from the beaten path become inevitable.

A series of insulated coils identical in every particular, possesing individually a long and a short side and not lying adjactent to each other in a manner that might lead

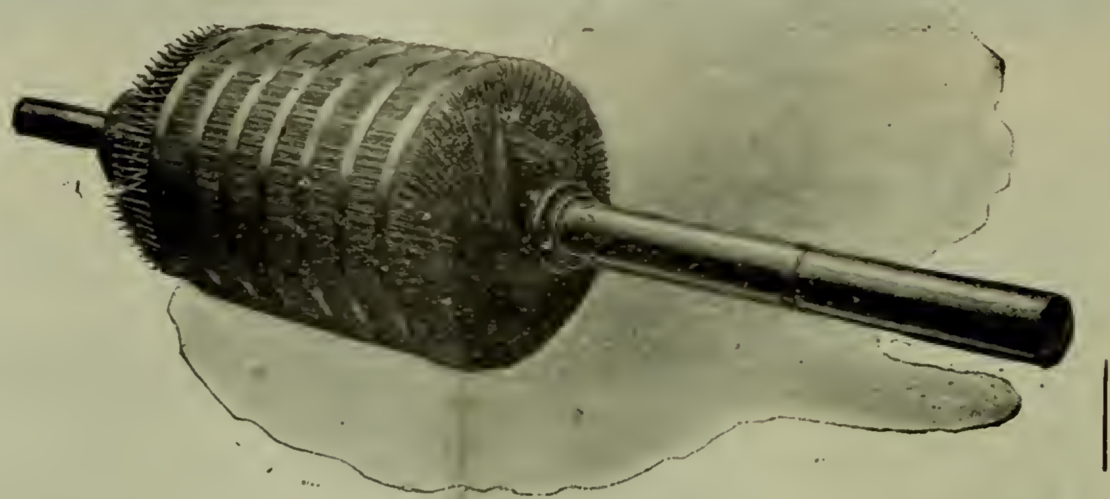
to short circuitig, represents in general the lines pursued by up-to-date manufacturers of electrical apparatus. In addition to the facility of repair offered by a winding whose resistance in every circuit equals a decided gain in space and means of obtaining perfect insulation are evident.

The casual observer cannot be well impressed with the various details of construction that must be entered into in the manufacturer of a complete line of armatures unless a visit is paid to the factory of some large concern. The illustrations show some of the processes through which armatures are put before completion, but do not in the least show the vast amount of experience required to bring them to their present state of comparative perfection. Uniformity in the winding of armatures is all important; the evil results of careless winding, loose coils, poor insulation, etc., are known and have been paid for in the past by many manufacturers.

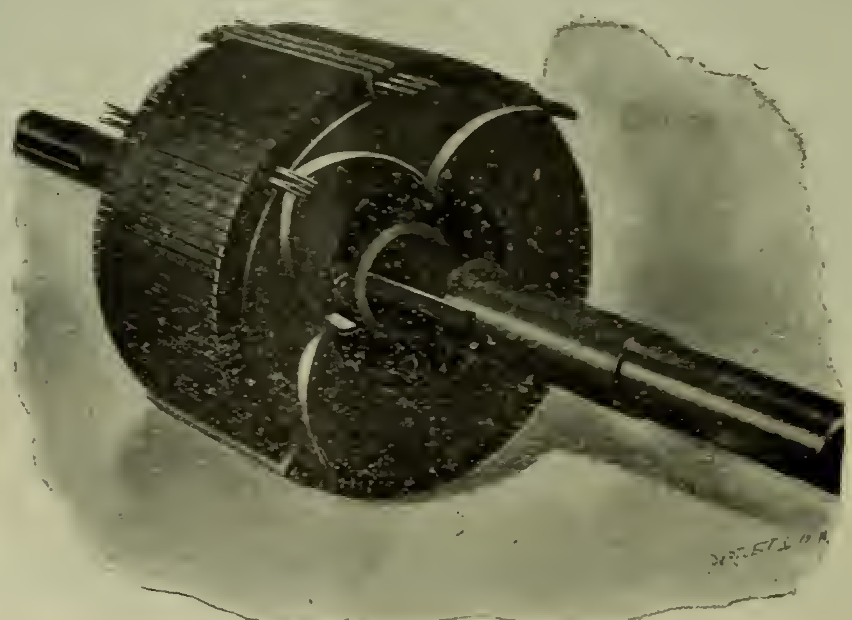
In order to obtain that accuracy in construction without which one armature is certain to be unequal from another of equal horse power, a great deal of automatic machinery is required without which those differences are certain to occur, from which spring variations in speed and output of the most embarassing nature. The smooth core armature was for many years considered best forreasons which appealed more to the prejudice of manufac-



C.-W. Ring-Type Armature Partly Wound.



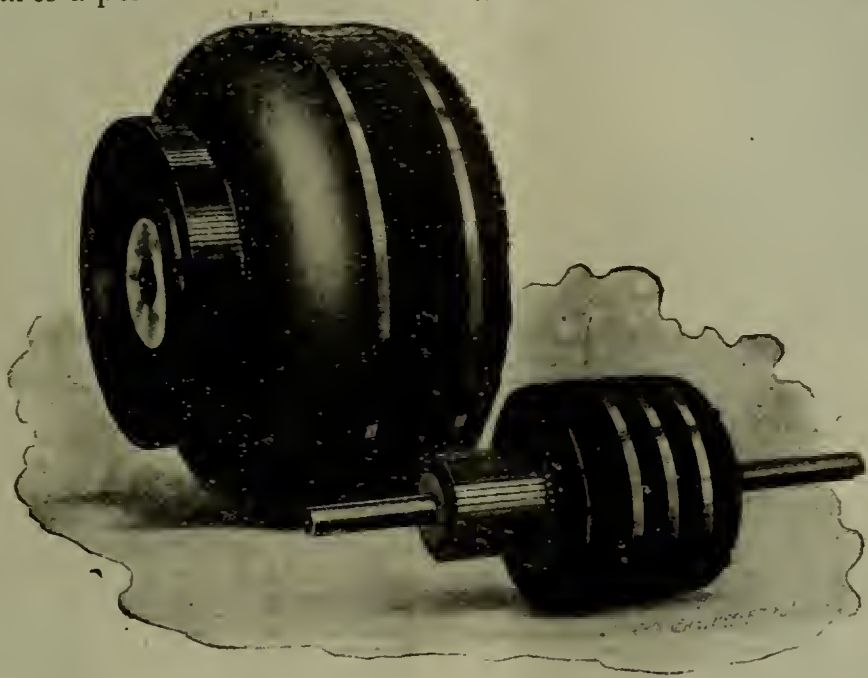
Smooth-Core Drum-Wound Armature by Other Manufacturers, Wires of Large Difference of Potential Lying on One Another.



C.-W. Two-Circuit Bar-Wound Armature, showing Connection Details

turers than a desire on their part to be progressive. Experience has shown, however, in a way that cannot be doubted, that toothed armatures by reducing the air gap reduce the amount of copper required on the field and diminish the total amount of iron of the frame.

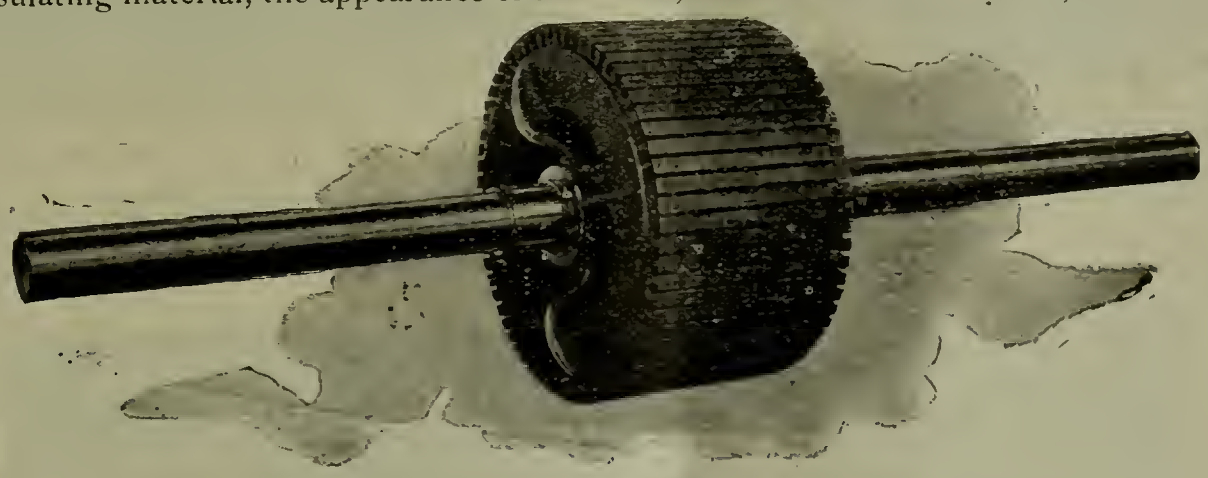
The leakage factor with a small air gap is less than that which would be proper for a large air gap. Consequently a saving in copper and iron, a saving in weight and a reduction in cost represent aggregately all that is required to make toothed armatures a permanent feature of



Comparison of Armatures, Size 2-100 (8 Pole, 2 H. P. at 100 Rev.), With Size 2 (Bi-Polar, 2 H. P. at 1,000 Rev.

both dynamo and motor. The series of illustrations found in this article and kindly loaned by the Crocker-Wheeler Electric Co., represent the various processes through which armatures are put before they arrive at that state of completion which will secure for them a reputation of the very highest.

The method of applying wire conductors, the filling in of the slots with insulating material, the appearance of the



Magnetic Core of Armature With Parallel-Sided Slots and Overhanging Teeth for the Reception of the Windings.

armature core before it is wound and the method of applying that special form of winding caled bar winding, certainly imply a careful and extensive study of this subject. In the sketch illustrating a two circuit, bar wound armature the method of making end connections is unique in that it saves an immense amount of copper bulging out at the ends and keeps the resistance down to a minimum. The conductors fit together in such a manner that they are never more than two deep at either end.

In an armature of this description whose bar conductors are protected from grounds from highest class of insulation power for power and weight for weight, none of different construction can equal it. If the conductors are subsequently locked in by wedges of vulcanized fibre, the mechanical perfection of this armature cannot help appealing to the practiced eye of any reputable mechanic. The armature cone of the slotted or toothed type consists of many discs of wrought iron securely fastened by nuts and bolts. In the larger sizes the wire is wound over the periphery but never through the interior as in the old-fashioned Gramme ring.

In consequence of this, ventilating space is secured, thereby giving to the armature a greater capacity for overload than it would otherwise possess. In the bar wound armature above mentioned, the rectangular bars are shaped so as to fit with perfect ease around the core. Ventilation in this type, the symmetry and simplicity make it capable of withstanding heavy strains. With a rigid frame, powerful fields, forged copper conductors and improved brush holder in addition to a toothed design, we have a generator or motor unexcelled in efficiency and durability.

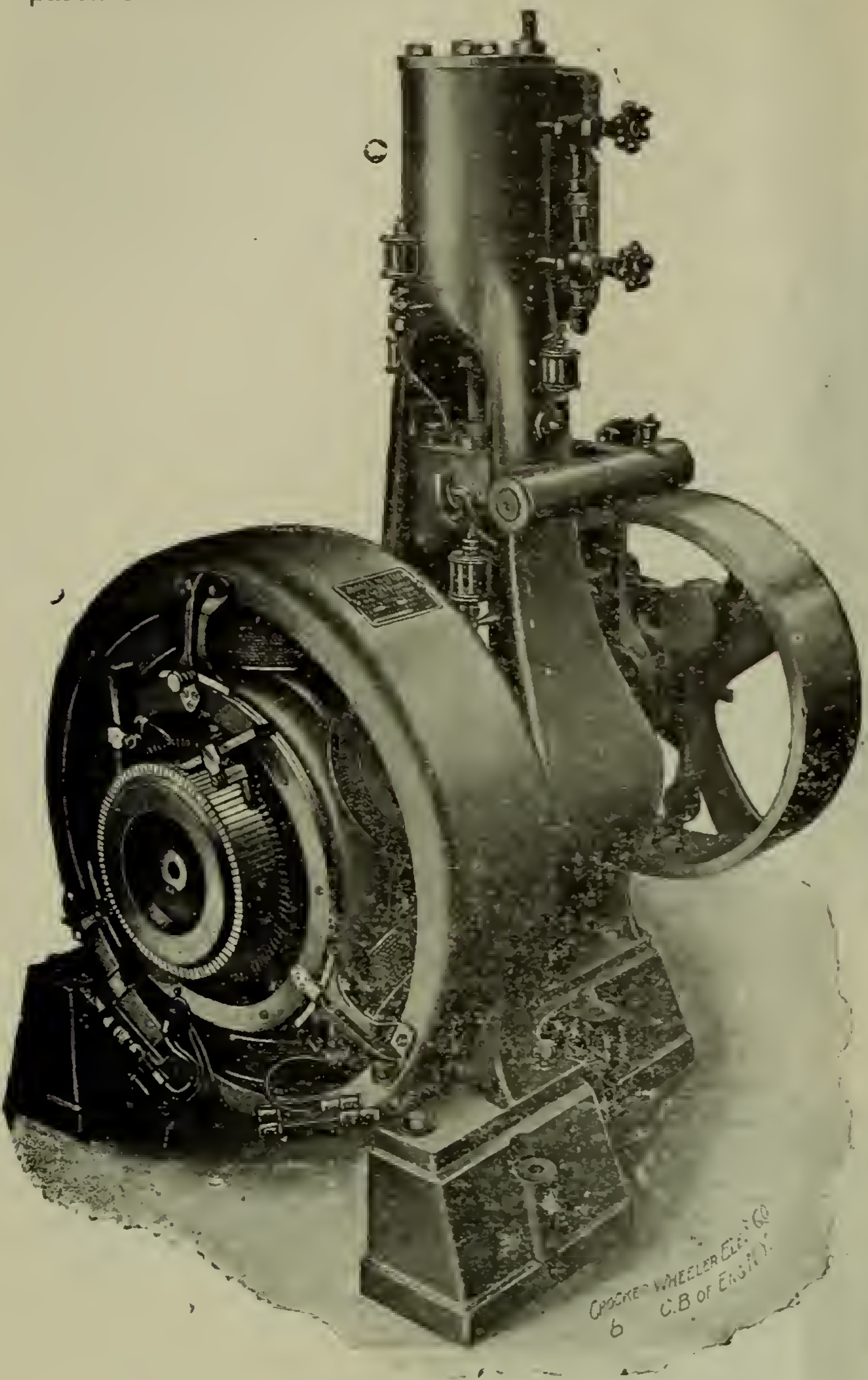
MOTORS FOR DIRECT CONNECTION.

In taking advantage of the progress made in the manufacture of motors, the proprietor or manager of a large machine shop acknowledges that benefits are derived of a financial as well as a mechanical nature. Modern practice, that of the last five years, has exceeded the anticipations of careful students of power transmission and its distribution. Although the consumption of fuel in a factory is not a great item in comparison with wages, still, if a means of diminishing this expense twenty, thirty, or fifty per cent. is found, it cannot help being welcome by those directly interested in such institutions.

The power waster in countershafting and belting represents from twenty-five to fifty per cent. of that developed for shop purposes. In consequence of this, the tendency in large machine shops has been to install either one large motor in the shop itself or a variety of them, each respectively connected by shaft to the machine it is to drive. The cost per horse power for the first year is large, in comparison with the expense incurred by the old-fashioned method of belting, but in works doing a large and flourishing business the operation of such a plant for five years would more than wipe out any existing difference between that generally accepted as correct and the so-called increase due to this innovation.

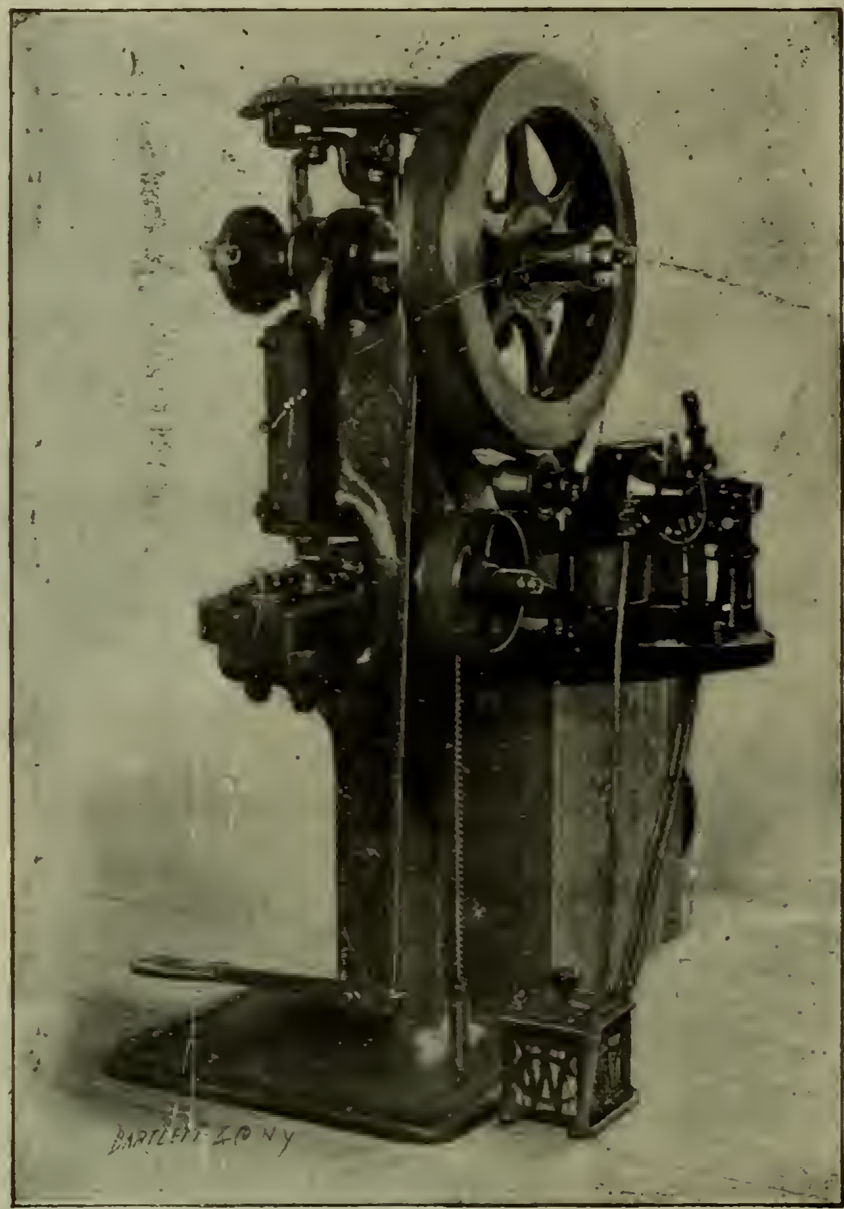
The absence of shafting of all descriptions, the absolute control of each machine, irrespective of the others, and

the saving in fuel at the end of the year, comprise in total a sum sufficient to promote beyond question a radical departure of this nature. In the illustrations are shown a few applications of the motor in the machine shop and engine room.

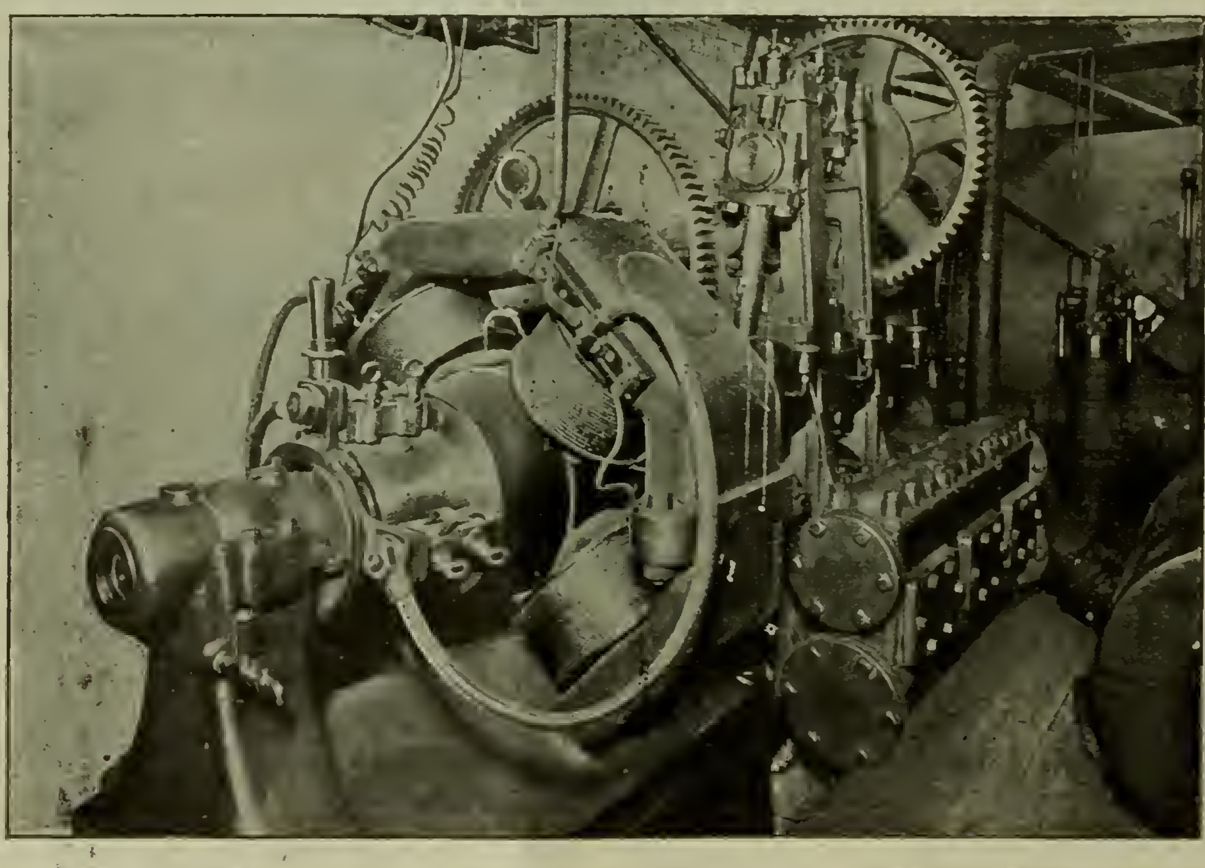


C.-W. Dynamo Direct Connected to Sturtevant Engine.

For the lighting of a small plant, both engine and dynamo may be direct connected, as shown, for example, in the Sturtevant engine and Crocker-Wheeler multipolar generator. By applying power directly where it is needed, a machine tool thus driven will do its work better and at less expense than by countershafting in the regular manner, as shown. A motor belted with idler to notching press, represents one of the successful innovations of the Crocker-Wheeler Co. In the Granite City Steel Co., of Granite City, Ill., the Crocker-Wheeler Co. have installed one of their size 25 motors in direct connection with a triplex pump. The final illustration refers to a most compact electric light plant suitable for apartment houses or large launches; in fact, wherever compactness, cleanliness and quietness are desirable features.



C.-W. Motor Belted With Idler to Notching Press.



C.-W. Motor on Triplex Pump, Granite City Steel Co., Granite City, Ill.

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CONTENTS:

TIME AND PRESSURE FOR PUNCTURING INSULATION.

It is less difficult to arrive at a conclusion regarding the qualities of insulation than of conductors. The conductivity of a metal is readily altered by the temperature surrounding it. An insulator however, when exposed to a given pressure, will, in the course of time, depending upon less important conditions, either resist or be perforated.

The General Electric Co., have decided to discuss this subject under the title of "The Puncturing Pressure." we quote as follows: "The puncturing pressure is the alternating current voltage which the given thickness of insulation will withstand for from thirty to sixty seconds. For underground or submarine work the working pressure should not exceed half of the test pressure. If wires or cables are run on insulators they may be safely worked at test pressure. It should be noted that series arc circuits are subject to from two to three times the normal voltage on the sudden rupturing of the circuit."

Some of the results obtained by tests show that five-thirty-seconds of an inch of rubber insulation will withstand a puncturing pressure of twenty-four thousand volts for one minute: An insulation of rubber of six-thirty-seconds of an inch in thickness withstood a puncturing pressure of thirty thousand volts. In the light of these facts it is clearly seen that the insulation employed for the protection of wires is certainly affected not only as regards the incidental pressure which it carries in every day practice but those tremendous outbursts of electro bagnetic energy caused by the sudden rupture of an inductive circuit.

In many cases the failure of insulation is not caused by its incapacity as a protective covering, useful against grounds, short circuits, etc., but simply because the unexpected pressures cannot be withstood by it. Short circuiting and grounds were inheritances from which few of the older types of machines were free. While this serious difficulty could not be attributed in such cases to the lack of care in construction it was often caused by inductive effects; the pressure arising from such causes approaching in many cases those values which render perforation possible.

Insulated wires and cables are exposed to such a variety of conditions when in use that it is almost impossible to state definitely their insulation resistances at any given time. A change of temperature, a rise or fall in the barometer, even the nature of the current, whether continuous or alternating, will have an influence upon the protective insulating covering. In spite of this, however, we are better able to arrive at a conclusion regarding the resisting power of a given class of insulating material than the true carrying capacity of a wire.

AN ENGLISH OPINION ON THE MEANING OF THE WORDS "SCIENCE" AND "SCIENTIFIC."

It is interesting to hear an expression of opinion from abroad on subjects that enter more or less into our daily lives. Mr. H. E. Armstrong discussing the subject says: "What meaning have the words "science" and "scientific" in English ears generally? Do they excite visions of a complicated picture of things concerning our daily life in its minutest details? Certainly not. Their utterance before those who know a little chemistry, recalls fireworks and smells and perhaps simple salts; whilst those who take an interest in electricity have thoughts of bells ringing, galvanometer needles wagging or glowing electric lights. Science, in the eyes of the average Englishman, consists of a new fangled set of ideas all very well for those who can afford the time to study them, but, in his opinion, not of such daily practical importance that it is necessary for the nation to pay attention to them. And this, unfortuately, is the opinion of even educated men and of many men of culture. Science is but exact knowledge and there are as many branches of science as there are of exact knowledge. A loose, incoherent body of facts does not constitute a science. A scientific man is a knowing man, not merely a man who knows but one who is properly described in the terms of the popular impression 'a knowing fellow,' implying something more than the mere impression of knowledge: implying the power to use it properly and with effect. To be scientific is to be as far as possible exact in thought, deed and word. To act with a purpose and after due and careful consideration. To be observant and thoughtful. To be logical and methodical. To be guarded but fearless in opinions and judgments and it is because we are so rarely truly scientific."

The advantages gained by scientific methods are so great that in all vocations of life a little science will go a great way. It is only when a profession, a trade or a business is founded upon basic principles that success can be expected with the application of intelligence and energy. In electrical engineering, from a mass of disconnected results scientific and semi-scientific, enough was selected to give the outline of methods of procedure.

As a consequence of this sifting process, the up-to-date motor, the up-to-date dynamo, the up-to-date arc and incandescent lamp appeared. In other words, science implied logic and without logic little can crystallize from our efforts, of any practical importance. Occasions do arise when accident help a man, but in the majority of cases they are the very things that must be overcome.

INSULATION.

VOLENITE.

Manufacturers of insulating materials have, of course, in a free country the right to name their wares as they please, but we regret to say that only in too many cases the name is chosen without any consideration of the character of the substance in question. At the present time a correspondence war is going in the "Financial Times" between the representatives of "volenite" and "ovoline." We must confess that before we read this correspondence we thought that "oxoline" was some fluid extract of beef. We find that 1-8 inch of oxoline will stand a pressure of 35,000 volts. The supporters of "volenite" claim that 1-8 inch of their material will stand 80,000 volts. Of course, all these claims for high resisting powers to disruptive discharges are quite valueless unless the mechanical and hygroscopic properties of the substances are suitable for use in electrical apparatus. In this respect we would remind the gentlemen in question that the craze for high insulation per mile of cable, has led to more faulty cables being produced than would otherwise have been the case. The makers of such cables may be compelled to attain the high insulation tests in their factory by means which have shortened the life of the insulation. In all such matters permanent, rather than excessively high resistance, is to be preferred.—Ex.

LIGHTING.

NERNST'S ELECTRIC GLOW LAMP.

"Optimist," London, writes as follows: "In the descriptions of the above which have appeared in the technical journals, and been published in the Patent Specifications, and also in the explanation and exhibition of the lamp given by Mr. Swinburne at the Society of Arts, great stress has been laid on the fact that the filament does not require to be sealed in a vacuum; Mr. Swinburne, indeed, went so far as to say that it would not work in a vacuum. Some of the speakers seemed to think that in a few months all our present glow lamps would be replaced by the new open filament lamps, and predicted bad days for the poor incandescent lamp manufacturers. It appears to me, however, that a most important fact has been entirely overlooked, no mention, whatever, being made of it, either by Mr. Swinburne, or by those who spoke in the discussion, namely, that the great strides made in electric lighting by glow lamps, are almost entirely due to the filament being enclosed in an hermetically sealed globe, thus rendering it quite safe, and allowing it to be used in many places where gas in any form would be out of the question, and so, of course, the exposed filament type of electric glow lamp. No doubt, for outdoor lighting, the Nernst lamp will be of great value; but a reference to the tables of electric light undertakings will show that outdoor lighting is a very small item in most central station accounts, so that the usual enclosed filament glow lamp would appear to still have the largest field, i. e., indoor lighting. No doubt the Nernst filament can be partially enclosed, and used indoors, too, but the advantages of a glow lamp with a filament hermetically sealed in a globe are so obvious, especially from the point of view of fire risks, that there is still hope for the oft-abused lamp maker, who produces glow lamps that will light without the aid of a match or a spirit lamp."

THE ELECTRIC LIGHTING OF TRAINS.

Mr. Robert A. Ross contributes to the January number of the "Canadian Engineer" an interesting resume on the electric lighting of trains. He divides the various systems which have been tried into five sections, which he arranges in order of first cost, commencing with the cheapest. These headings are as follows: (1)A steam dynamo in the guard's van; (2) engine and dynamo in the luggage van, with a battery and accumulator in each coach; (3) a similar arrangement with a dynamo in the guard's van, the dynamo being driven off the axle; (4) accumulators in each car with charging stations at intervals along the line; and, lastly, a small dynamo and battery on each car, the dynamo being driven from the axle. The last two headings represents systems which Mr. Ross considers most useful in general practice. He advocates however, in the fourth system, that the charging stations should not be established for that purpose only, but that the required current should be taken from a lighting plant already in use. He considers that the chances of failure are greatest where the power is taken from an axle of a carriage, but even then the breakdowns recorded are very few, indeed. Mr. Ross points out the difficulty of obtaining any correct figures as to the cost of the work, but considers it proved that the interest and depreciation account will be the largest item in the cost. Where the battery system is used and the batteries are charged at intervals, he advocates the use of high-efficiency lamps, in order to reduce the weight and cost of the accumulators. —Ex.

AUTO-MOBILES.

BREAKING IN AUTOMOBILE "CABBIES."

Consul-General Gowdy, of Paris, in his annual report, says that during the past year there has been a marked increase in the adoption of automobiles, not only as pleasure vehicles, but for practical application in the way of cabs serving the public in the city of Paris, and for business purposes in the way of delivery wagons, especially those for long distances. It is announced that at the beginning of next year there are to be 100 motor cars driven by electric power runningin the streets of Paris, and, if the experiment be successful, the cabs will be increased to 1,000. With this project in view, a large plot of ground has been acquired, where the building of works necessary for the housing of the cabs and the machinery for the electric supply are being rapidly completed. A training ground has also been made for the cabmen. This is laid out with every possible form of paving, wood, asphalt, stone, etc., including two steep hills. Here and there are dotted about a number of dummy figures, and in and out of these the cabmen have to maneuver, under the orders of an instructor. As a rule, in four lessons, it is stated, the driver is ready to navigate Paris, and after ten lessons is considered thoroughly competent. Each cab is supplied with sufficient power to be driven thirty miles at about eight miles an hour.

ELECTROLYSIS.

ELECTROLYSIS OF IRON AND LEAD PIPING.

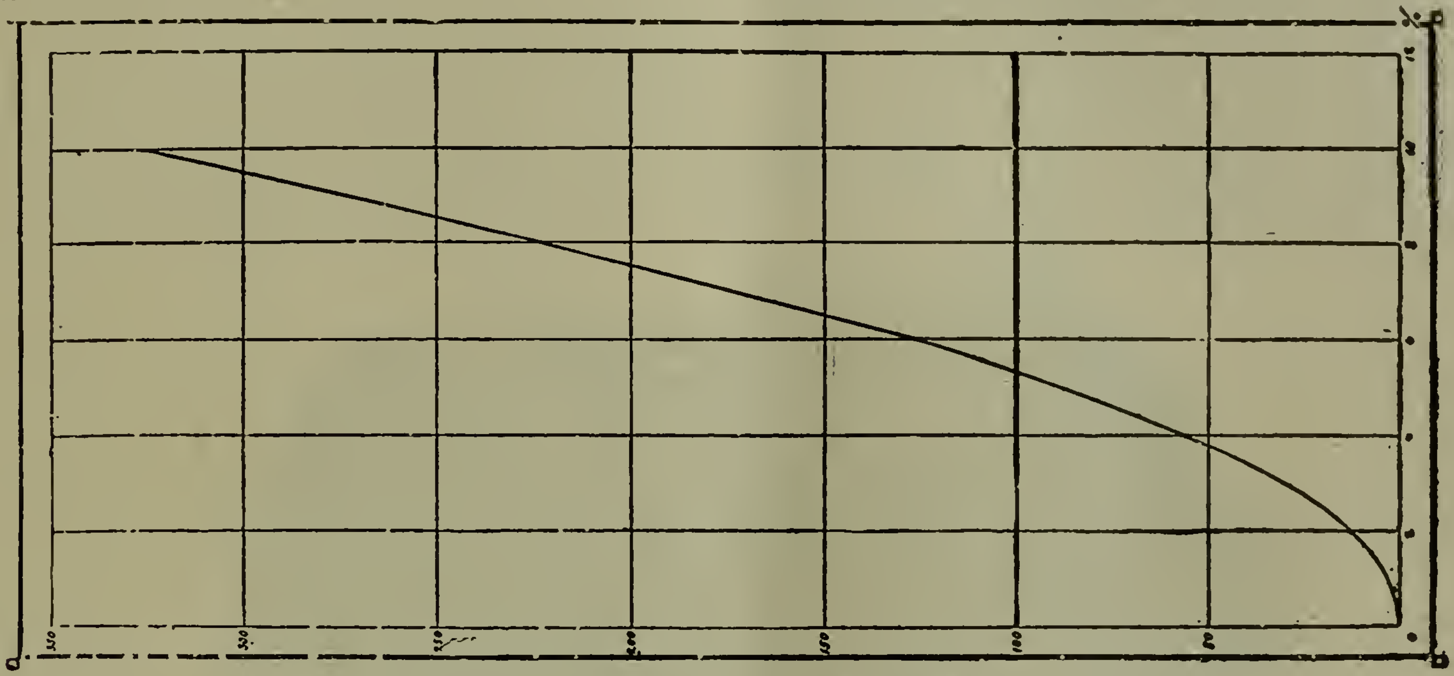
Attention has recently been called to the condition of the iron and lead piping under the streets of Dayton, O. In ordinary soils a cast-iron pipe is not affected materially by electrolysis, that is, the combined action of the electric currents set free from the ground return to the electric street railways, the pipe, and the surrounding earth. In Dayton, however, the soil from recent analysis is found to contain a large percentage of sodium carbonate and chloride, which, by the electrolytic action of currents set free by the ground return feeder of the electric street railways are converted into hydrochloric acid. This acid readily dissolves iron, and the result is, after three or four years, serious injury to both the iron piping and the rails of the electric lines. Several remedies for reducing this electrolysis have been suggested, chief among which are the better bonding of the track and the adoption of wooden pipes, bound with spiral hoops of iron, the whole to be heavily covered with asphaltum. If these details are carefully considered and carried out, the electrolysis can be reduced in most instances to a practically negligible quantity.—The Railway Review.

THE ELEMENTS OF ARC LIGHTING.

It might seem strange to speak of separately excited generators, in the same breath with arc lighting, but, in earlier days when little was known of the principles of electrical engineering the separately excited dynamo was all we had. A constant field, such as is produced by a separately excited dynamo, will not give a constant potential at the brushes.

about eighty volts, wastes more power in this respect than two of the open globe type.

In connecting up an alternating current lamp the connections as given in diagram will be found most convenient to follow. One of the advantages of alternating current arc lighting is that a transformer, installed to operate in conjunction with one or two arc lamps, acts like a choke coil in not wasting the surplus of power



Characteristic Curve of Arc Light Dynamo.

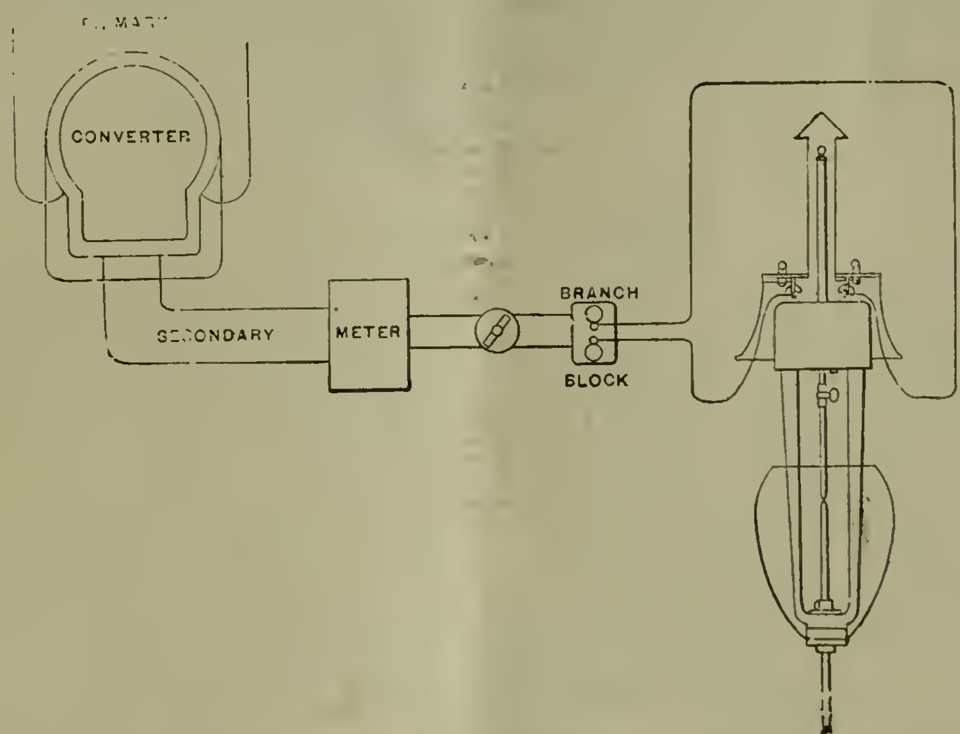
as in an ordinary resistance. The calculation of drop by the rule that the circular mils are equal to the length of the conductor in feet, multiplied by the amperes, multiplied by twelve and divided by the volts loss only needs the extra modification of allowing about ten per cent. additional cross section in copper.

The influence of armature re-action is so severe that both incandescent and arc light dynamos are equally affected by it. The nearest approach to separate excitation is found in a shunt wound machine but in these dynamos, in order to preserve a constant potential for incandescent and constant potential arc lighting, a compound winding is necessary.

The use of permanent steel magnet for fields is not, in the light of our modern science, an advantage. Without an auxiliary exciting device it would be absolutely impossible to attain the same fineness of regulation that we do to-day.

ARC LIGHTING DYNAMOS.

In cases where lighting is to be done exclusively by arc lamps in great numbers, it is usual to arrange the lamps all in series, even to as many as one hundred or two hundred lights. With continuous current, arcs cannot



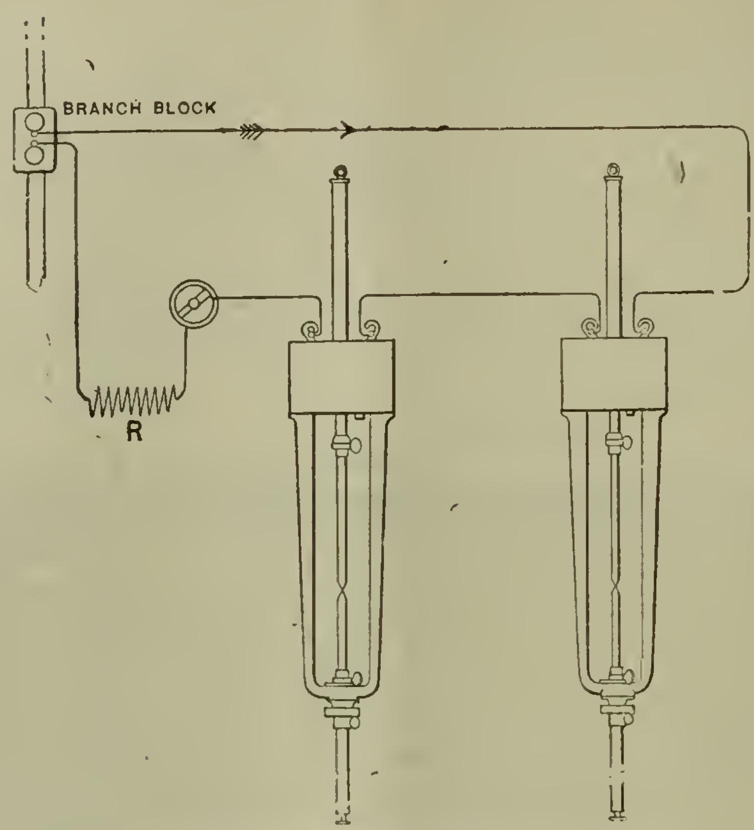
Arc Lamp Connected to Alternating Current Circuit.

The curve shows the rise of potential in an arc light machine with a ten ampere load, at between three and four hundred volts. Strictly speaking, a series dynamo is only the best for arc lighting when such is of the high tension order.

Arc lighting in the streets and home is in the end better done by the use of low tension machinery. The waste of power in the resistance connected in series with two arc lamps on one hundred and ten volts consumes very little power; the enclosed arc lamp, consuming

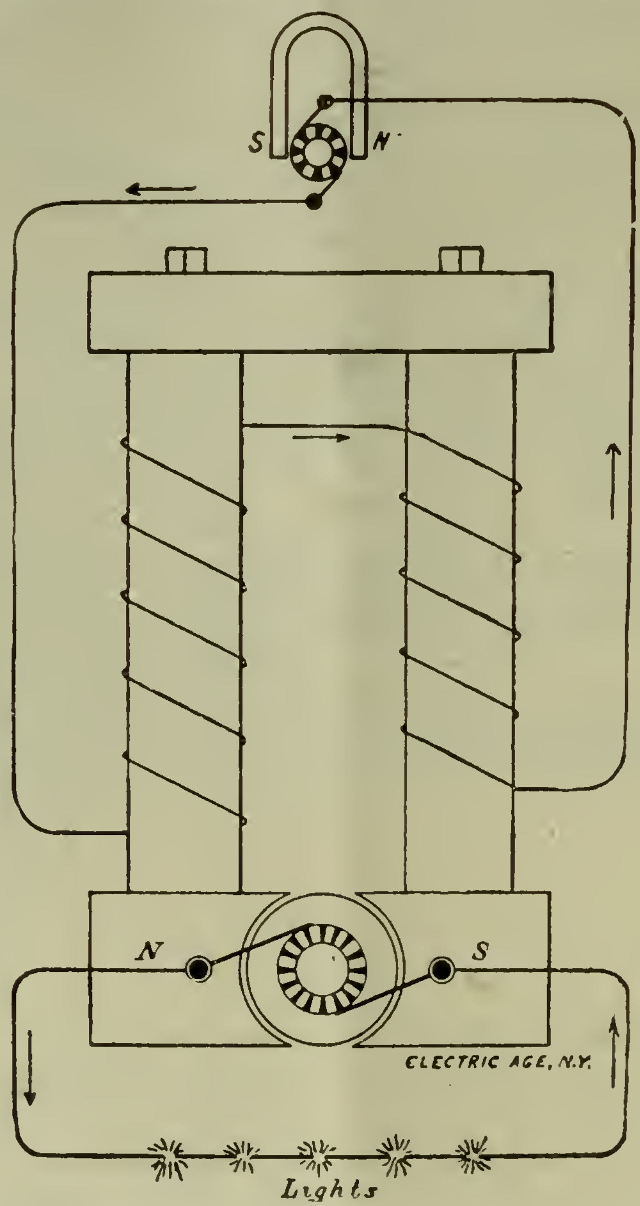
be maintained burning steadily unless they are fed at a pressure of forty or forty-five volts to each lamp. With insufficient pressure the arcs hiss and a counter electromotive force of about thirty-nine volts is generated in the steady arc. The preservation of a constant potential in incandescent lighting is reversed in this case which requires a constant current. Open and closed coil arc light dynamos represent the two great classes in use to-day. The Thomson-Houston dynamo possessing a spherical armature, three part commutator and arma-

ture is one of the most remarkable in use. In the original form of armature the three coils, which constituted it,



Connections of Arcs on Incandescent Dynamo.

were wound with their three ends connected together and the other three extremities ending up in the com-



Connections of a Separately Excited Dynamo.

mutator bars. The windings are one hundred and twenty degrees apart. In polyphase work this method of connecting would be called star connections.

When this armature is rotated in the cavity between the cup-shaped poles, alternate current are generated in each coil in turn, which are consequently rectified by the three part commutator. If the width of the gaps between the segments of the commutator be equal to the width between the adjacent brushes, each coil will be out of circuit, whenever it is more than sixty degrees from

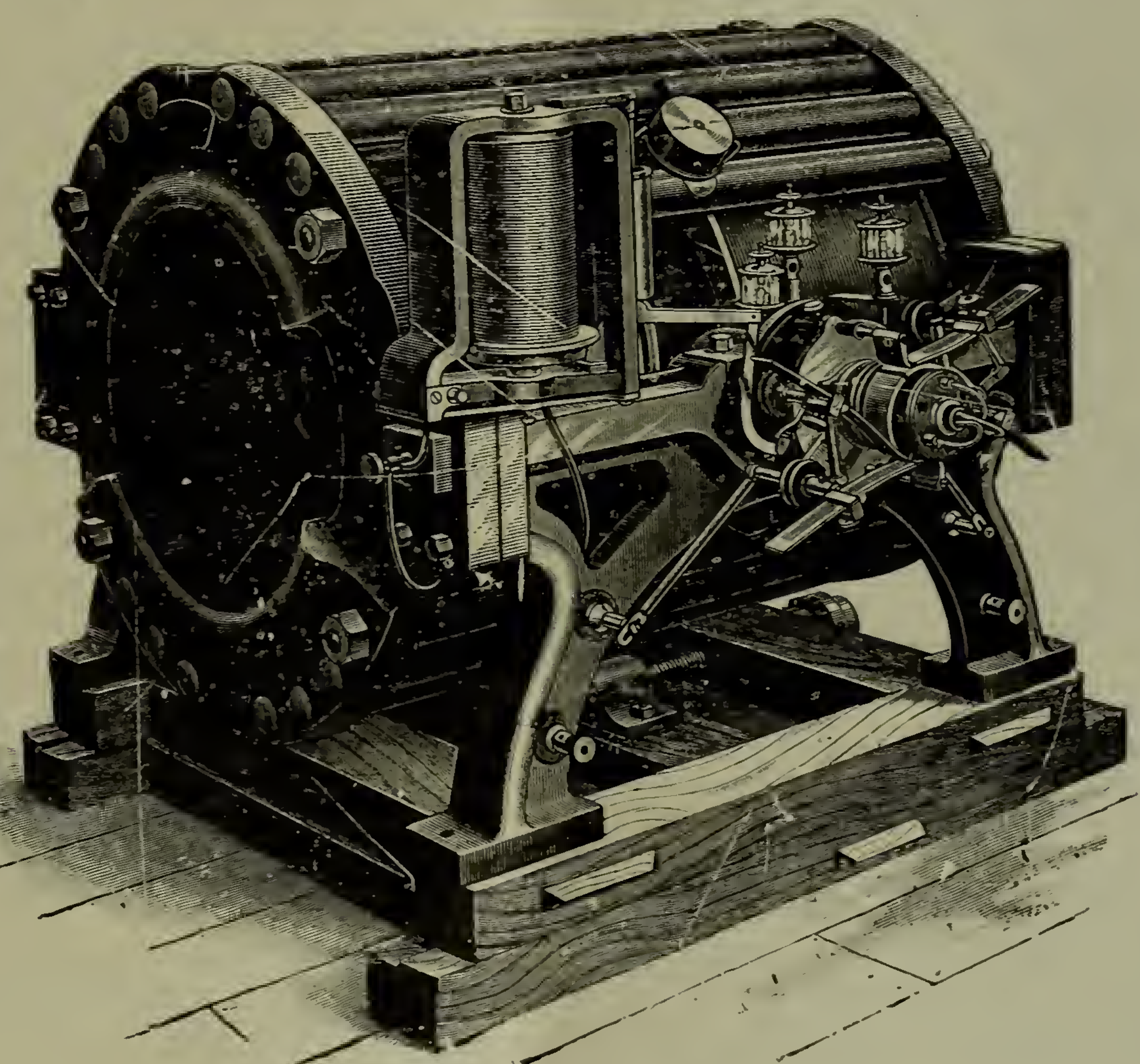
the position of maximum action, and the time during which any two coils are in parallel would be practically nothing. The automatic shifting of the brushes gives sufficient regulation to keep the current constant.

MISCELLANEOUS.

STRAY CURRENTS.

REFUSE FOR FUEL FOR ELECTRIC LIGHTING

London city refuse used as fuel for electric lighting has been very successful at Shoreditch. The cost of disposing of the street refuse was formerly $30,000 per year, which included the collection and dumping at sea. The cost of gas for street lighting was $20,000 per year. The new electric plant cost $60,000, and the cost for the first year was $19,070 for labor, supplies, insurance, etc. The interest, rent, depreciation, etc., cost $10,205, making a total of $29,275. The gross receipts for the sale of power and light were $43,205, giving a net profit of $15,930.—Ex.



Thomson-Houston Arc Machine.

REDUCTION IN CABLE RATES.

The Western Union Telegraph Co. and the Commercial Cable Co. announce that from March 1 next, the cable rate to joints in Holland and Belgium will be the same as to Great Britain, Germany and France, or 25 cents per word. This is a reduction of 7 cents a word to Holland and 5 cents a word to Belgium.

A STEAM MOTOR CAR.

The Baldwin Locomotive Works are not setting up a new steam motor car for the Pennsylvania. It will have a speed of 40 miles an hour and carry sufficient coal to run 50 miles. It is resigned to meet the competition of electric roads.

THE ELECTRIC SPARK.

The electric spark is not as simple as it appears. A German electrician has found that each spark is preceded by several brush discharges from both poles, each successive brush extending further outward until the gap is bridged and the spark passes. The spark discharge is complex, being made up of several partial discharges, of which the first is strongest. The preliminary brush discharges usually appear as appendages of the spark, and as they are seen in lightning photographs, it is probable that lightning is preceded by pilot brush discharges.—Ex.

A PECULIAR LAWSUIT.

The "Engineer" tells of a peculiar lawsuit brought by the captain of the port of Leghorn, Italy, against the owners of certain wooden yachts. These yachts were copper sheathed, and were moored with steel cables to a buoy in the harbor to which some of warships and other steel vessels were also fastened. Under these conditions electrical action took place, the bottoms of the vessels being the plates of a very large battery, and the fact of damage to the steel vessels by the electrolyses was clearly established by the evidence submitted. The court directed the removal of the yachts to another part of the harbor.

ELECTRIC LIGHTING AT YOKOHAMA.

A curious cause of breakdown is described in the last number of the "Indian Engineer." It seems that the electric lighting of Yokohama is carried out by overhead wires which are not insulated. The recent failure of the light is said to be due to the intelligent youth of Japan flying an exceptional number of kites at a certain festival. The introduction of the electric wires hampered the kites' fliers, and we regret to say that the reverse was also true, as the tails of these kites became so entangled with the wires for the incandescent service that the current had to be interrupted.

BRIDGE BUILDING BY MEANS OF ELECTRICAL MACHINERY.

A bridge of 900 feet span, at Budapest, is being erected entirely by means of electrical machinery. The iron girders ued as piles to keep the water back from the excavations for the shore pillars were driven in by an electric ram. The ram was a hammer rising 34 feet with a velocity of 12 feet per second. The spoil out of the hole was raised by an electric windlass. The water was removed by seven centrifugal pumps working day and night. The 5-inch diameter pumps were driven by 10 horse power motors, the 8-inch by 16 horse power, and one 9-inch by a 20 horse power motor.—Scientific American.

ELECTRICITY IN EGYPT.

The Duke of Connaught recently laid the foundation

stone of a new dam crossing the Nile at Assouan, thus inaugurating a work which will have a vast fertilizing effect in Egypt. The following few figures will be of interest from the fact that they indicate that a large system of electrical distribution can be supplied from this new dam. The length of the dam, which will be built on the solid granite, will be a mile and a quarter. It will be 80 feet wide at the base, and 80 feet high, and will holde du head of water 46 feet higher above the dam than the discharge. As the discharge is to provide for 54,000,000 tons of water per hour at full Nile, the vast amount of energy which will then be runing to waste is easily calculated.—Ex.

EDISON'S BABY CRADLE.

When Thomas A. Edison's second daughter was born, says the New York "World," his technical assistants in the laboratory at Orange presented him with plans for a cradle intended to save Mrs. Edison much worry and trouble usually experienced by mothers. Several other ideas were submitted to the committee, but the thought of the Wizard ambling up and down the room in the dead of the night, occasionally stepping on a semi-submerged tack, was too much for them, so the cradle was decided on. It was called the "automatic electric baby tender." It was an ordinary cradle with ingenious devices for the child's comfort attached. Immediately above the spot where the baby's head would lie was a diaphram, somewhat like a telephone receiver. If the infant should start crying, at the very first fail communication was established between the diaphragm and an electric clock. At the same time the cradle was set rocking by means of a small motor. If the remonstrance continued beyond a certain time the clock released a lever, and an arm attached to the side of the cradle (operated by what is called a bell crank lever), carrying a nursing bottle, was swung over the baby's mouth. If hunger was not the trouble, and the wails continued, another arm on the opposite side swung over the child's mouth with paregoric. At the same time the electric current was turned into a set of magnets placed around the cradle, and any pin which might be causing the trouble would be at once removed. If the yells continued, the "thirty-third degree" was applied. Two arms, lying flat in the cradle under the baby, were slowly raised and the child turned over. Then an electric spanker fastened to the footboard proceeded to do its work with neatness and dispatch. However, Mr. Edison persists in regarding the baby's joy electric cradle as a joke.

The Langton Electric Co., of Pittsburg, Pa., says the "Electrical World," is equipping a crane boat with waterproof magnets, capable of lifting 4,000 pounds each, to recover a large load of steel rails which was sunk in the Ohio river.

BUSINESS NEWS

LOWE & LEVERIDGE.

We take great pleasure in announcing the formation of a co-partnership between Messrs. Ernest A. Lowe and Charles W. Leveridge, both well known through their extended experience in the electrical supply line. Messrs. Lowe & Leveridge have opened a general electrical supply business in all its branches at No. 183 Greenwich st., New York City, paying particular attention to the needs and demands of insulated plants and with special facilities for the immediate attention to emergency calls.

Mr. Lowe has had seventeen years experience in business, the last thirteen of which have been in the electrical field. He has been connected at various times with Pearse & Jones, Western Electric Co., United Electric Light and Power Co., and last served in the capacity of manager for J. Jones & Son, of 64 Cortlandt street, the great success of the latter firm during the past six years being an eloquent testimonial to Mr. Lowe's sterling worth and indefatigable exertions.

Mr. Charles W. Leveridge has had a wide commercial and financial experience—the last seven years being in the electrical line—and for three years had charge of the entire isolated plant business of J. Jones & Son, the ever-increasing volume of which attests his ability and worth in that direction.

With two gentlemen of their experience and energy associated together, prosperity will not fail to come and we join with their numerous friends in wishing them every success in their new enterprise.

SPECIAL EXPORT COLUMN.

TOTAL ELECTRICAL EXPORTS FOR WEEK ENDING FEBRUARY 21, 1899, $73,609.

New York, Feb. 21, 1899.—The following exports of electrical material, etc., are from the port of New York for the week ending this date:

Antwerp—Forty-three cases electrical material, $2,932.

Brazil—One hundred and thirty packages electrical material, $5,985.

British Guiana—Eleven packages electrical material, $98.

British Australia—Two hundred and three packages electrical material, $18,653; 1 case electros, $30.

British East Indies—Seventeen packages electrical material, $993.

British Possessions in Africa—Three cases electrical material, $165.

Cuba—Seventeen packages electrical material, $729.

Christiania—Five packages electrical material, $97.

Chili—Three cases electrical material, $225.

China—Forty-two packages electrical machinery, $7,208; 17 cases electrical material, $654.

Dutch Guiana—Two cases electrical material, $25.

Danish West Indies—Two boxes electropoise, $21.

Ecuador—One case electrical material, $160.

Hamburg—Eighteen cases electrical material, $2,469.

Havre—Forty-eight packages electrical material, $6,765.

London—Seventy-three packages electric cable, $20,174.

Mexico—Fifty cases electrical material, $938; 1 electric launch, $876.

Marseilles—Twenty-nine cases electrical material, $750.

Milan—Two cases electrical machinery, $440; 4 cases electrical material, $979.

Nova Scotia—One package electrical material, $24.

Porto Rico—Two packages electrical material, $50.

Rome—One case electrical machinery, $83.

Siam—Ten cases electrical material, $857.

Southampton—Six cases electrical material, $300; 5 cases electrical machinery, $355.

Zurich—Two cases electrical material, $27.

U. S. of Colombia—Eighty-five packages electrical material, $547.

NEW INCORPORATIONS.

Harrisonburg, Va.—The Merchants' Light & Power Co., incorporated by J. R. Green and others; capital stock, $10,000.

Windber, Pa.—Windber Electric Co., has been incorporated by Thos. Fisher, W. A. Crist, Osceola Mills, and J. S. Cunningham; to supply light, heat and power. Capital stock, $10,000.

San Francisco, Cal.—Winfield Resetting Circuit Breaking Co., has been incorporated by E. F. Winfield, A. A. Anderson, C. L. Ackerman, A. E. B. Ridley and S. L. Napthaly; for the purpose of manufacturing, selling and repairing electric goods. Capital stock, $10,000.

Pittsburg, Kans.—The Pittsburg Gas, Electric Light and Power Co., has been granted application for charter. Capital stock, $50,000.

Greenville, Miss.—People's Light Co., has been incorporated by Harley Metcalf, Fred Metcalf, George Metcalf and others to furnish light, power and heat. Capital stock, $25,000.

Vicksburg, Miss.—Vicksburg Electrical Supply Co., has been incorporated by M. J. Mulvihill, S. R. Hughes, and M. B. Landau; to carry on a general electrical business. Capital stock, $250,000.

Trenton, N. J.—East Jersey Electrical Co., has been incorporated by C. F. Johnson, S. H. Taylor, and J. P. Cooper; to manufacture and deal in electricity, light, heat and power of all kinds, including compressed air.

Cazenovia, N. Y.—The Union Electric Co., has been incorporated by John O'Connell, David O'Connell, Thos. O'Connell, N. S. Miller, and James Dougherty. Capital stock, $25,000.

Camden, N. J.—Miller Electrical Maintenance Co., has been incorporated by J. J. Miller, Charles E. Schmunk, James R. Baird, W. C. Thoma, and William Bader; to carry on a general electrical business. Capital stock, $100,000.

Grand Island, Neb.—Joehnk-Waldman Co., has been incorporated by Henry C. Joehnk, Ignatz Waldman, and John C. Waldman; to maintain an electric light, power and gas plant. Capital stock, $50,000.

Natchez, Miss.—Natchez Light, Power and Transit Co., has been incorporated by MauriceMoses and Abram Moses; to furnish light, power and heat, and operate an electrical railroad. Capital stock, $250,000.

Philadelphia, Pa.—The Pennsylvania Electrical Vehicle Co., has been organized, with W. W. Gibbs, president. Capital stock, $2,000.

Waterville, Me.—Atlantic Manufacturing Co., has been incorporated by Charles E. Bibber, Herbert W. Smith, and Cyrus W. Davis; to manufacture electrical apparatus. Capital stock, $1,000,000.

Stockbridge, Mass.—Callendar Power Co., has been incorporated by Chas. E. Callender, John S. Fuller, and Frederick S. Aymar: electric heat, light and power, etc Capital stock, $5,000.

Charleston, W. Va.—North American Air Motor Co., of New York, has been incorporated under the laws of this State, by Lucius T. Gibbs, Thomas Holden, Jr., Chas. Engel, John French, and D. H. Lyon; to manufacture and sell apparatus operated by compressed air, steam or electricity. Capital stock, $1,000,000.

Jersey City, N. J.—Commercial Cable Co., has been incorporated by Clarence H. Mackay, George G. Ward, Albert B. Chandler, Edward C. Platt, G. W. Clapperton; Albert Beck, Wm. W. Cook; to construct and operate an electric telegraph between Cuba and the United States. Capital stock, $500,000.

Humboldt, Iowa.—The Humboldt Electric Lighting and Power Co., has been incorporated by N. H. Knowles, S. G. Winne, R. F. Oestrich, P. E. Ward, and others; telephone exchange. Capital stock, $10,000.

Harrisonburg, Va.—The Merchants' Light and Power Co., incorporated by J. R. Green, H. L. Bushong, C. F. Thomason, E. B. Cootes, and I. S. McNeill; to manufacture and distribute gas and electricity in Rockingham County, Va. Capital stock, $10,000.

Norfolk, Va.—Norfolk New Light Co., incorporated by W. H. Davis, Sr., E. M. Henry and others; to buy and operate lighting and heating plants.

Middleport, N. Y.—Middleport Power Co., has been incorporated by Frank G. Lott, Thomas J. Wilcox, Wm. J. Sterrett, Geo. F. Thompson, and Byron C. Stanton; to manufacture electric light, heat and power. Capital stock, $15,000.

Indianapolis, Ind.—The Jenney Electric Manufacturing Co., has increased its capital from $50,000 to $80,000.

Dalas, Tex.—Southwestern Electrical Engineering & Construction Co., has been incorporated by Sam P. Cochran, J. L. Sale and Frank Reeves. Capital stock, $20,000.

Nunda, Ill.—Citizens' Electric Light and Manufacturing Co., has been incorporated by Marcellus L. Joslyn, E. E. McCullom, and E. G. McCullom; to manufacture and sell light, heat and power. Capital stock, $10,000.

Bourbon, Ind.—Bourbon Water & Light Co., has been incorporated by C. M. Leekman, John C. Dales, and C. C. Layton; to operate water works and electric light system. Capital stock, $11,000.

Winthrop, Mass.—Winthrop Gas and Electric Co., incorporated by Simon J. Donovan, and others; to manufacture, buy and sell gas and electricity, etc. Capital stock, $100,000.

Paterson, N. J.—A big gas, electric and power combination has been formed in this city to control all the gas and electric plants in the county and a few of those in Bergen County. The United Gas Improvement Co., is at the head of the deal. All the lighting companies of Paterson, Passaic city, and Lodi, will hereafter be under one management, and the following have been chosen directors: William Bartsour, president; Garret A. Hobart, Bird W. Spencer, Hobart Tuttle, B. M. Shanley, John R Lee, John W. Ferguson, E. T. Bell, and Randall Morgan. The capital stock is $5,000,000, and bonds to the amount of $5,000,000 will be issued.

TELEPHONE CALLS.

Carlisle, Ky.—The East Kentucky Telephone & Telegraph Co., incorporated by Dr. G. W. Evans, F. H. Adair, F. B. Lindsey and others. Capital stock, $1,000.

Smithville, Tenn.—Smithville Telephone Co., has been incorporated by R. L. Cautrell, T. J. Patton, W. W. Parker, W. B. Parker, and others; to conduct and operate a telephone line. Capital stock, $1,000, with privilege to increase it to $14,000.

Meriden, Conn.—The Commercial Automatic Telephone Exchange Co., has been formed with a capital of $250,000. The company proposes to establish the system which does away with the "hello girl" throughout the State.

Indianapolis, Ind.—The Central Union Telephone Co., has filed a mortgage for $6,000,000 gold bearing bonds. The mortgage covers all franchises and other property owned by the company in this State, and was given to the old Colony Trust Co., of Boston.

Eureka, Ill.—Eureka Telephone Exchange Co., has been incorporated by J. A. McGuire, F. B. Stumpf and L. Carr. Capital stock, $2,500.

Dover, Ill.—Dover Telephone Co., has been incorporated by Chas. O. White, M. H. Blackburn, and Jas. W. Sabin; to carry on a telephone business. Capital stock, $2,000.

Wheaton, Ill.—DuPage County Telephone Co., has been incorporated by Margaret I. Isgrig, Henry M. Fisk, and Frank Seward; to operate a telephone exchange. Capital stock, $10,000.

Carlisle, Ky.—East Kentucky Telephone & Telegraph Co., has been incorporated by Dr. C. W. Evans, F. H. Adair, F. B. Lindsay, and others; to rent and operate telephone lines. Capital stock, $1,000.

New Hope, Ky.—The New Hope Telephone Co., has been incorporated by F. W. Hogan, T. P. Hogan, E. Miles Hogan; to erect and operate telephone lines. Capital stock, $1,000.

Fordsville, Ky.—The Fordsville-Harrison Telephone Co., incorporated with John T. Smith, Jr., president; Dr. E. W. Ford, vice-president; Ike C. Adair, treasurer; and J. D. Cooper, secretary; for the construction of a telephone system. Capital stock, $1,000.

Maysville, Ky.—The Germantown, Minerva & Maysville Telephone Co., incorporated by M. C. Russell & Son, Brittain & Lloyd, T. C. Winter, Judd & Co., and others. Capital stock, $500.

Rogersville, Tenn.—The Tennessee River Telephone Co., incorporated by J. R. Roark, T. R. Webster, R. D. Keller, J. R. Sanders, and J. D. Walker. Capital stock, $1,000.

West Leyden, N. Y.—Constableville and West Leyden Telephone Co., has been incorporated by John J. Demser, Philip J. Demser, and Fred Myers; telephone line Capital stock, $3,000.

Anna, Ill.—Jackson Union Telephone Co., has increased its capital stock from $35,000 to $75,000.

Milford, N. Y.—The Milford Telephone Co., has been incorporated by Geo. Whitney, C. B. Kniskern, C. E. Carr, and others; to operate a system of telephonic communication from Oneonta to Richfield Springs. Capital stock, $1,000.

STREET RAILWAY NEWS.

Lexington, Ky.—Lexington Railway Co., has been incorporated by John T. Shelby, John R. Allen, R. P. Stall, and others. Capital stock, $800,000.

Lansing, Mich.—Lansing, Dexter and Ann Arbor Electric Railroad Co., has been incorporated by Rush J. Shank, C. P. Black, C. A. Mapes, and R. A. Montgomery; to construct and operate a street railway. Capital stock, $250,000.

Carrollton, Mo.—Steps are being taken to erect an electric line from Carrollton to Waverley.

Lexington, Ky.—The Lexington Railway Co., incorporated by John T. Shelby and others; for the purpose of furnishing light, heat, power, gas and electricity. Capital stock, $800,000.

Xenia, O.—The Xenia and Spring Valley Transit Co., has been incorporated by C. J. Ferneding, O. O. Ozier, J. M. Wilson, H. L. Terneding, and Philip A. Kemper; to build and operate an electric railway between Xenia and Spring Valley. Capital stock, $5,000.

POSSIBLE INSTALLATIONS.

South St. Joseph, Mo.—City Clerk may give information concerning contemplated erection of electric light plant.

Arcadia, Fla.—C. C. Chollar, Secretary of Board of Trade, may give information concerning proposed establishment of electric light plant.

Tampa, Fla.—The Consumers' Electric Light & Street Railway Co., will expend $50,000 on improvements to its plant.

Pulaski, Va.—John T. Loving, Mayor, may be addressed concerning contemplated erection of electric light plant.

Bristol, Tenn.—The Bristol Belt Line Co., will build an electric power plant.

Wadesboro, N. C.—City Clerk may give information concerning proposed construction of electric light plant.

BUSINESS CHANGES.

Ironton, O.—The Ironton Electric Light and Railway Co., Edward S. Wilson appointed receiver.

Trenton, N. J.—The Columbia Electric Car Lighting Co., has increased its capital stock to $10,000,000.

The Electrical Age.

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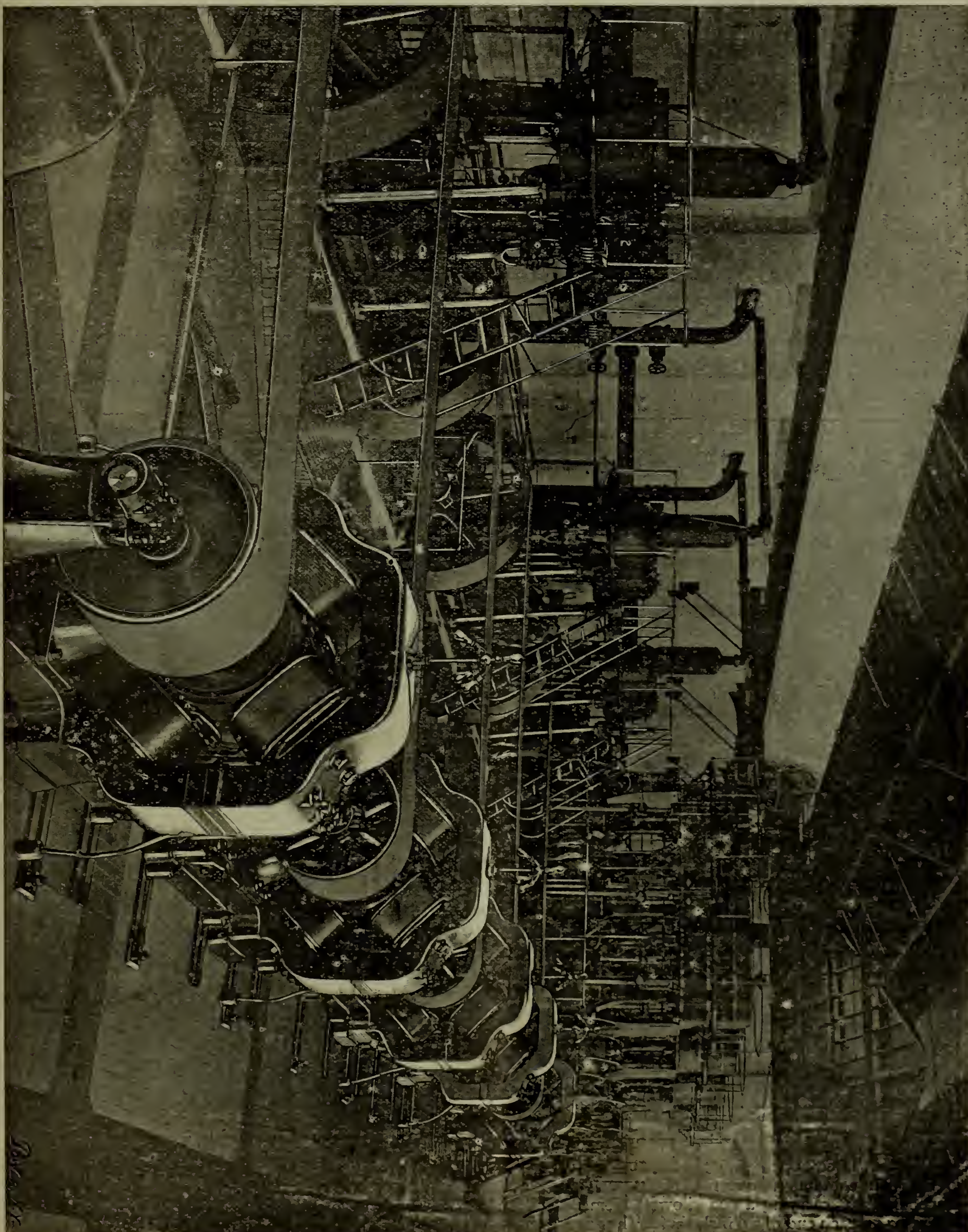
ELECTRIC LIGHT AND POWER.



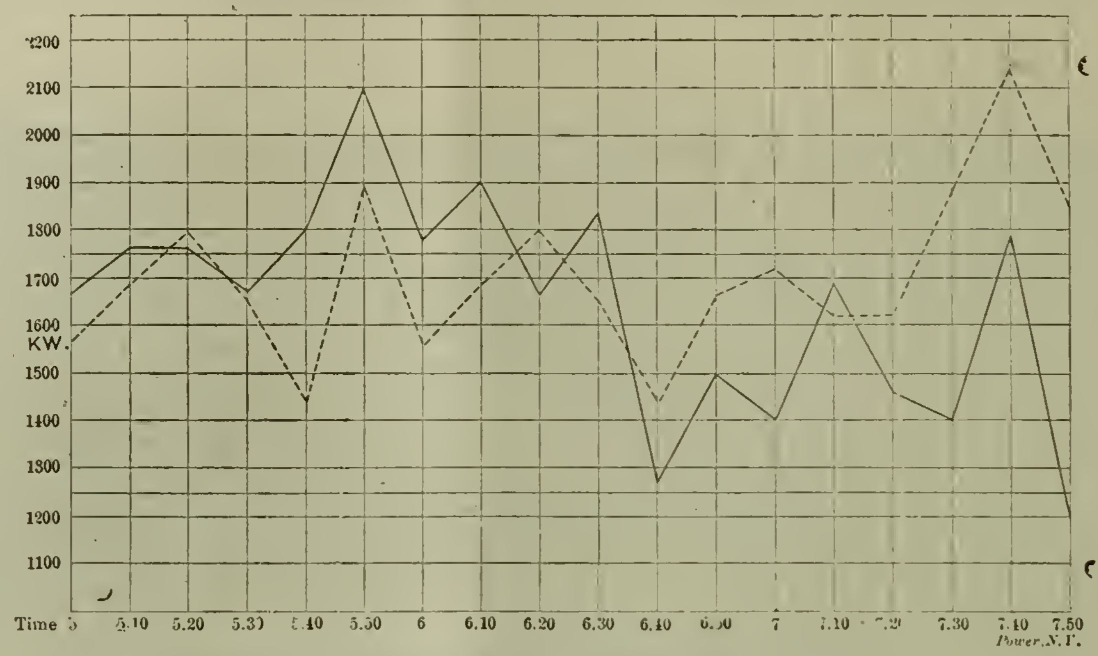
Engine Room, Electric Station Market Street Railway Company, San Francisco, Cal.

POWER STATION OF THE MARKET STREET RAILWAY CO., SAN FRANCISCO, CAL.

Through the courtesy of "Power."

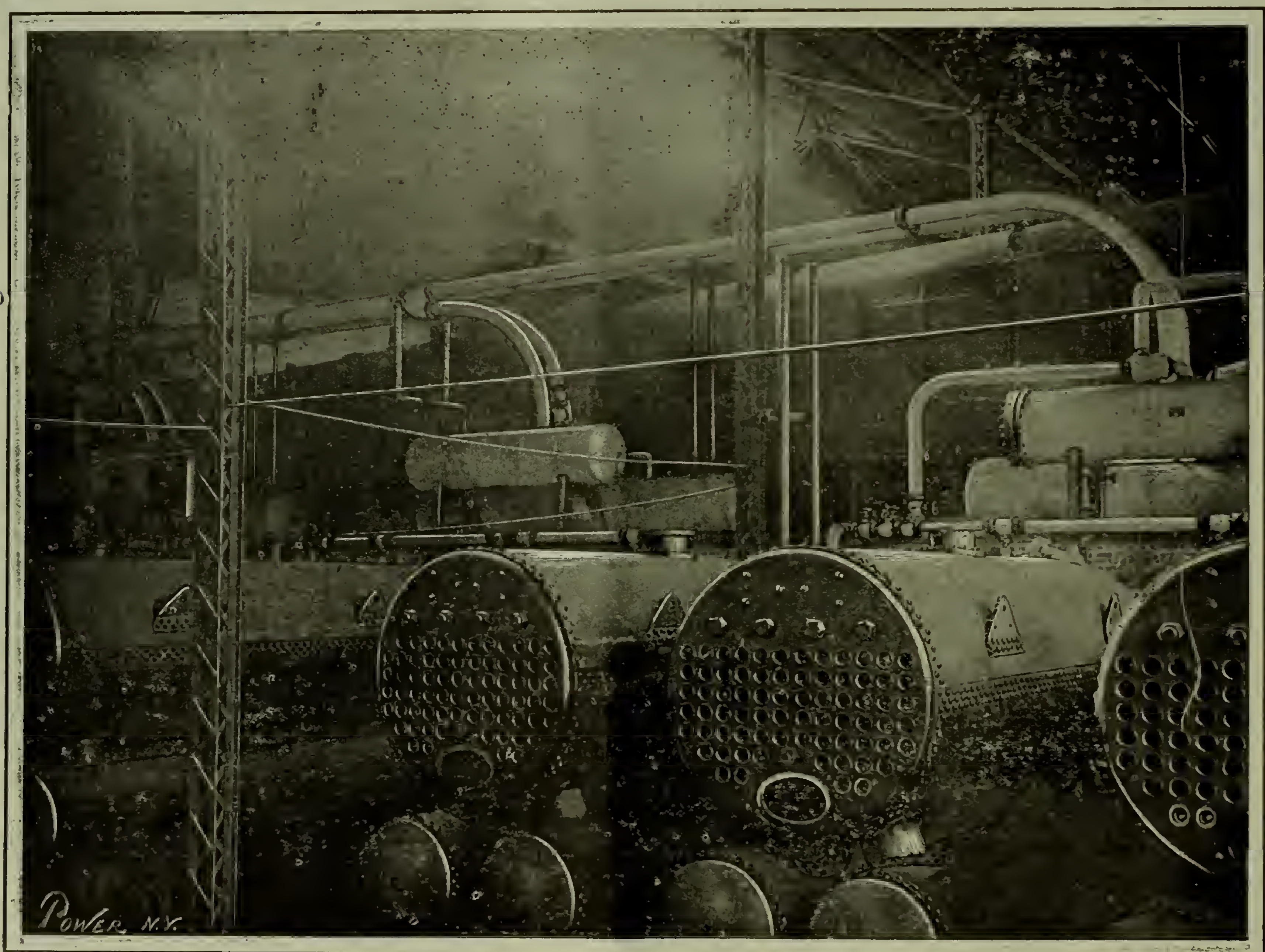
In the city of San Francisco, Cal., are operated a number of cable street railways with power houses at convenient points. These cable lines are supplemented by an electric system, the whole being operated by the Market Street Railway Company.

The subject of our illustration is the power station supplying current for the operation of the electric system.



Load Diagram, Electric Railway Station, San Francisco.

cylinders 20 x 30 x 40 inches with 30 inch stroke. Piston valves are used, an Ideal shaft governor controlling the cut off on the high pressure cylinder only. A surface condenser is set in the bed of each engine. The exhaust steam is passed through the tubes of the condenser, which are surrounded by the condensing water. Steam is supplied to these engines at 160 pounds pressure. The vertical section on this page shows the general arrangement of the engines and dynamos and also the location of the condenser.



Elephant Boilers in Electric Station, Market Street Railway Company, San Francisco.

This station is equipped with modern machinery. The engine room contains four vertical triple expansion direct connected units carrying a 400 kilowatt Siemens-Halske generator on each end of a 9 inch shaft. The engines have

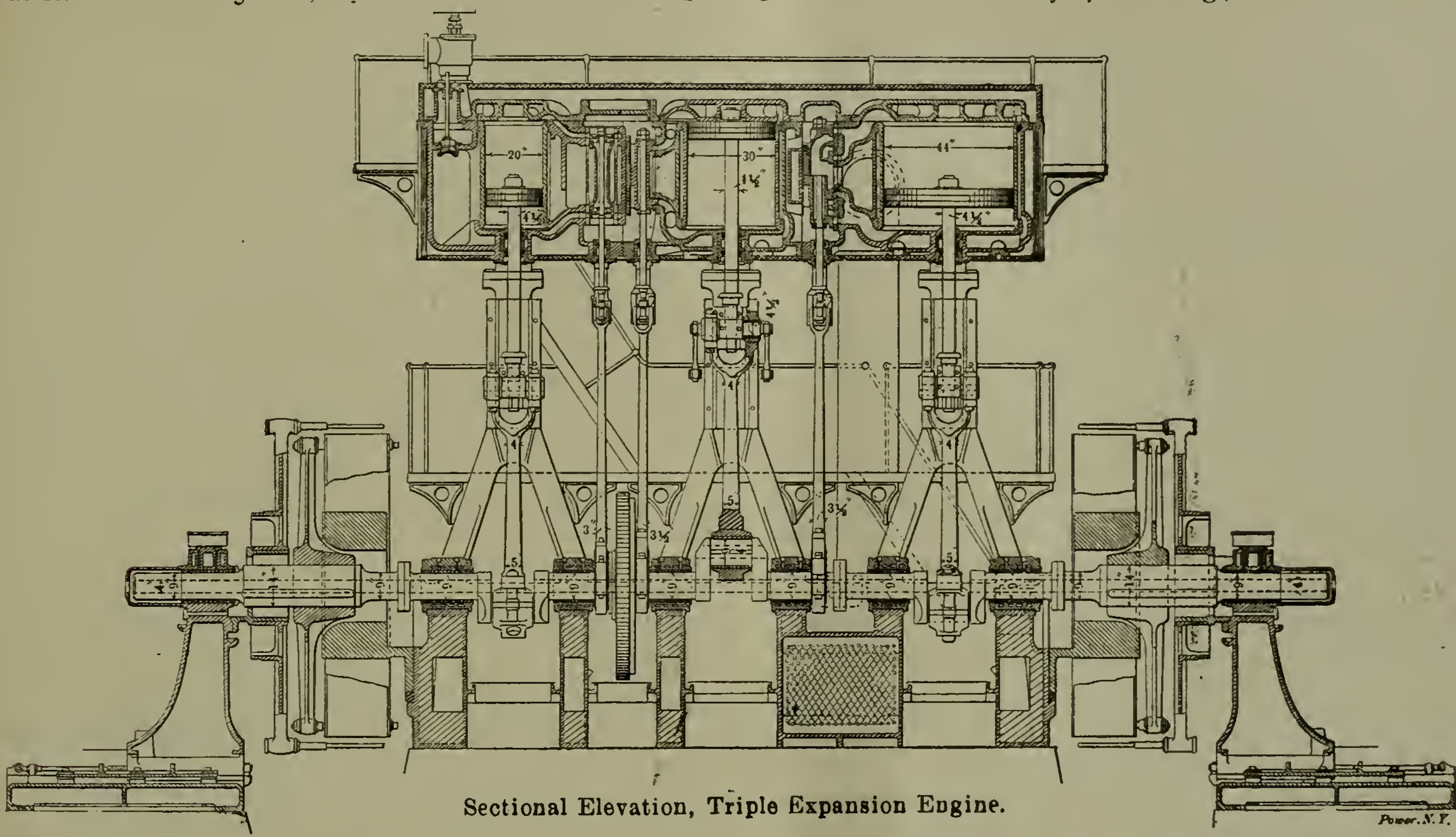
The engine room also contains four vertical compounds belted to General Electric generators. Two of the compounds have cylinders 22½x39 and 24 inches rated at 600 horse power each; the other two have cylinders 16

x 28 and 24 inches and are rated at 300 horse power each. The steam pressure for these engines is 130 pounds.

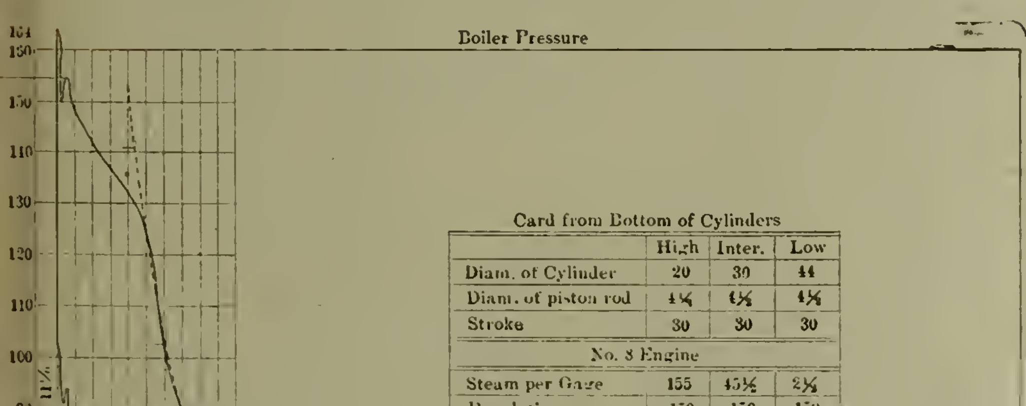
The water for condensation is pumped from the bay, a distance of one mile, through a 36-inch pipe, at an elevation of about 25 feet, by means of two centrifugal pumps driven by 50 horse power electric motors. The pumps and motors are in duplicate, one only being required to supply sufficient water for condensing purposes.

The boiler room is equipped with the elephant or French types of boilers set in four rows of three batteries each, each battery containing three boilers.

These boilers derived their name originally, from their size, as they sometimes exceeded 50 feet in length. Nine of those in the plant under discussion have a steam and water drum 60 inches in diameter by 16 feet long, and contain 72 three and one-half inch tubes. The shell is of steel 7-16 of an inch thick, heads 1-2 inch. There are two mud and water drums under each steam and water drum, 30 inches in diameter by 17 feet long; each of these drums are connected to the steam and water drum by two water legs 13 inches in diameter, set near the front and rear heads of the shell. Above each battery is a steam drum conected to each boiler by a neck 10 inches in diameter. These steam drums are 36 inches in diameter by 19 feet long; the steam from them is conveyed to the main through 7 inch connections. These nine boilers supply the steam for the compound engines at 130 pounds. Each battery has 80 square feet of grate surface and each boiler 1,588 square feet of heating surface.

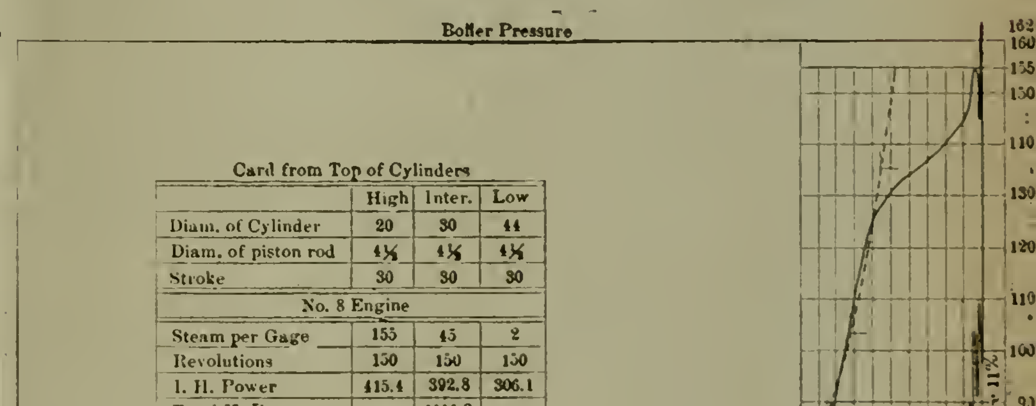


Sectional Elevation, Triple Expansion Engine.



Card from Bottom of Cylinders

	High	Inter.	Low
Diam. of Cylinder	20	30	44
Diam. of piston rod	4¼	4¼	4¼
Stroke	30	30	30
No. 8 Engine			
Steam per Gage	155	45½	2½
Revolutions	150	150	150
I. H. Power	415.1	392.8	306.1
Total H. P.		1111.3	
Volts	560		
Amperes	1300		
Electrical H.P.	975.8		
Efficiency	.87¼		



Card from Top of Cylinders

	High	Inter.	Low
Diam. of Cylinder	20	30	44
Diam. of piston rod	4¼	4¼	4¼
Stroke	30	30	30
No. 8 Engine			
Steam per Gage	155	45	2
Revolutions	150	150	150
I. H. Power	415.4	392.8	306.1
Total H. P.		1111.3	
Volts	560		
Amperes	1300		
Electrical H.P.	975.8		
Efficiency	.87¼		

The other 27 boilers supply steam at 160 pounds for the triple expansion engines. They have steam and water drums 64 inches in diameter by 16 feet long, with shells of steel 1-2 inch thick, made up of two sheets double-riveted with 6 inch lap, rivets 7-8 inches, 3-4 inch pitch. The heads are ⅝ inch double riveted to shell. In the other details they are the same as the smaller boilers. Each has 1,588 feet of heating surface, and each battery 60 square feet of grate surface. They are connected to the main by 12 1-2 inch connections. The steam main is 16 inches in diameter.

The boilers evaporate 7 1-2 to 8 pounds of water per pound of coal. The Howden system of forced draft is used.

The feed water is taken from the hot well at about 140 degrees, passing through a heater, where it is raised by the exhaust from the pumps to 180 degrees. From the heater it passes through Hoppes purifiers situated on top of the boilers; most of the scale forming material is thus removed. The feed enters the boilers from the purifiers by gravity just below the water line. All the steam mains are drained and trapped. Separators are placed on each engine branch close to the engine the branch serves. The oil is removed from the condensed steam by an ingenious filter arrangement. A sheet iron tank is built in which trays are placed one above the other so that the water will run by gravity from one to the other. These trays are filled with hay. The condensed steam is brought to the filters by a 3 inch pipe. The tanks are 4 x 6 x 4 feet. The hay in the trays is changed every five days—3-4 of a bale is used in each tank, the station being equipped with six of them, three being used at a time. Suitable doors are provided for removing the hay when necesary.

On this page two sets of diagrams from the triple expansion engines are shown, the full data for each being given. A chart showing the variations of the load on the station is also shown on this page.

The station was constructed by the Union Iron Works, of San Francisco who also built the engines and boilers.

CLOTH PRESSING BY ELECTRICITY.

At a recent meeting of the Industrial Society of Elbeuf, a report was made by Mr. Ch. Mouchel, on a new process invented by Mr. Chedville, which is known as the "electro-calidor" process, and consists of pressing cloth by means of boards heated by electricity.

A special committee appointed for the purpose examined the manufacture and operation of the press boards. The result is declared to be most satisfactory, and the report is as follows:

The body of the press board is composed of asbestus paste, covered by a netting of German silver. This is again covered by paper pulp, which gives a pliable surface without materially increasing the thickness of the press board, which measures from 2 to 4 millimeters (0.078 to 0.157 inch). The first experiments were made by applying the electric current through holes pierced in the portion of the board projecting beyond the cloth. Experience, however, has led to the adoption of press boards with a trapezoid projection, of which the two obtuse angles are covered with copper. Spring clips, provided with a metal connection and attached to a pliable conductor, serve to transmit the electric current to the copper-covered corners of the boards, when the press is arranged for the work.

The electric press boards are used in the following manner: On a plate of sheet iron is placed a piece of cloth, between the folds of which are placed at equal distances three electric press boards; then there is another plate of sheet iron, another piece of cloth, and so on until the press is full. An ordinary press holds eight pieces, the folds of the cloth being one meter (1.09 yards) wide.

The Messrs. Blin employ a system of hollow presses, and an iron track, sufficiently long to accommodate ten, communicates with each one of their hydraulic presses. Against the ceiling and parallel with this track are arranged two conductors, one positive and one negative. They are placed on either side and a little beyond the line of the track. Large clips for transmitting the electric current are attached by pliable wires to these conductors. The hollow press is then placed beyond two of these clips, each of which communicates with a movable vertical distributer.

The clips are readily adjusted to the metal corners of the electric press boards, the positive on one side and the negative on the other. The current is thus established and the proper degree of heat generated, the time necessary varying from three-fourths of an hour to one hour and a half.

The required current for a press board measuring 1 meter (1.09 yards) by 70 centimeters (27.5 inches) is 2 amperes under a pressure of 110 volts. A press of eight pieces, with twenty-four press boards, demands a current of 48 amperes to heat the press, and the amount of electric force expended in one hour and a half is as follows: $48 \times 110 \times 1.5 = 7{,}920$ watts per hour. The mechanical force given a dynamo of 90 per cent. working capacity is $\frac{48 \times 110}{736 \times 0.9} = 12.5$ horsepower. The labor expended in one hour and a half is as follows: $12.5 \times 1.5 = 18.75$ horsepower per hour.

Supposing a consumption of 1.5 kilograms of coal per horsepower per hour, the quantity of coal necessary to heat a press may be estimated at about 30 kilograms (66 pounds). Estimating coal at 25 francs ($4.83) per ton, the maximum cost of heating a press would then be 75 centimes (14 cents).

Comparison being made between the amount of coal required by the new system of pressing and the old—viz., direct heating in a special oven by means of sheet-iron plates interspersed between the folds of the cloth—it is found that the old method is slightly dearer than the new, as the Messrs. Blin, who used the old system with as little waste as possible and had thirty presses per day, state that they used at least a ton of coal a day for the heating of their plates, which involves an expenditure of 33 francs (6.37) for the presses used, or 1.10 francs (21 cents) per press.

There is thus an economy of fuel, but the new system has other and more important points of superiority.

The first is the perfection of the work. The heating of each press, and even of each piece, can be regulated mathematically, either by varying the number of press boards or by increasing or diminishing the length of the heating. The cloth is heated slowly and without the inequalities resulting from the old system, under which the two ends of each piece were almost in contact with plates heated to 500 degrees. All manufacturers who have employed the new system speak of this point as a great advantage.

A second advantage is the extreme cleanliness with which the pressing can be effected. The old style of plates heated in an oven often resulted in soiling the cloth, which is now entirely avoided.

Another advantage is the economy in laborious handing necessitated by heating and transporting heavy cast-iron plates. The workshops can also be kept at a lower temperature, more favorable to the health of operators.

The heat generated in the folds of the cloth is completely utilized by the new process, and a fraction less is lost by radiation than under the old system of heating by plates.

If there is already an electric plant in the establishment (and few modern houses devoted to commerce or manufacture are without one), the expense is reduced. The boards are not costly, and with proper care will last several years.

Mr. Mouchel thinks that the process above described is, from all points of view, a most important invention and should be generally adopted. W. P. ATWELL,

Roubaix, January 18, 1899.

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CONTENTS:

THE ELECTRICAL MICROSCOPE.

This rather strange name has been applied to a rather supersensitive instrument with which physicists and electrical men are pretty well acquainted. The magnifying power of a microscope may reach four or five thousand diameters but for the detection of the most transient and minute currents, the Thomson reflecting galvanometer cannot be equalled or excelled.

The part a galvanometer has played in the history of electrical engineering is so important that it is impossible to separate from it the greatest of inventions. The galvanometer in the hands of Michael Faraday gave to the world an electro magnetic generator whose influence upon civilization is most manifest in our own large cities. By means of this instrument currents were detected which would have escaped even that famous investigator's notice without the aid of the galvanometer.

Its use for telegraphic purposes in England by Wheatstone is indicative of its practical value for comparatively rough work. The great cable laid by Cyrus Field and others became primarily a success through the good offices of the galvanometer as improved upon by Lord Kelvin. The degree of sensitiveness a reflecting galvanometer possesses can hardly be estimated or compared without making heavy demands upon the imagination. It is with respect to currents of electricity more indispensable than the microscope. Its power of magnification, its ability to throw upon a scale a spot of light and move it through a distance of many feet when a current of less than one ten-thousandth of an ampere passes, is almost miraculous.

Yet small as the ampere is, physicians make use daily of millivoltmeters and milliameters whose needles detect thousandths of an ampere or volt. A true representation of the value of the galvanometer has been made by Prof. John Trowbridge, of Harvard University.

"The galvanometer can detect slight molecular disturbances; it can also reveal mysterious effects in the ether of space. One sometimes smiles at the microscopist who disputes with a fellow microscopist on the possibility of measuring spaces of one hundred thousandth of an inch. Yet one should reflect that the antiseptic treatment in surgery which saves thousands of lives every year, is due to the perfection of the microscope. To those unlearned in electrical science, too, the tiny movement of a needle or the excursion of a spot of light over the scale seems hardly worthy the attention of a liberally educated man. Yet the modern dynamo and the telephone owe their existence to the study by Faraday and Henry of these minute movements."

DANGERS OF THE VITASCOPE.

At the Convention of the International Association of Fire Engineers, held in St. Louis last October, a paper was read by Capt. William Brophy, of Boston, Mass. His intention was to show the danger which is ever present when a vitascope, kinetoscope or similar apparatus is carelessly handled. He recommends the use of a metal lined box when arc lamps supply illuminating power. He also advocates a large metal pan containing sand upon which the machine rests. A second recommendation is to the effect that a shutter between the lense and film should be always available for the purpose of cutting off the light in case the film ceases moving.

His close acquaintance with the rules laid down and observed by contractors doing electric lighting are in perfect harmony with reason. By applying them to these instruments, a great deal of unnecessary risk and danger to life and limb of those witnessing an exhibition are avoided. His statement regarding the protection, so necessary when a great amount of highly inflammable material is exposed in the shape of a hundred and fifty foot film, is worthy of the most careful consideration.

He says: "When the ray of a powerful light is focussed on one spot of the film for a very short time, it will burst into flame. Should the film be accidentally interupted in its passage between the lamp and the lense unless the rays of the light were quickly shut off by a shutter, the film would ignite. If allowed to reel off on to the floor or into an open box, the whole mass would be quickly aflame and with no means at hand to extinguish, the consequences would be fearful to contemplate."

The large vaudeville halls are of late very careful in projecting kinetoscope views, to see that every precaution is taken to prevent fire, explosion or a more harmless interruption. We recommend to such of our readers as might not fully appreciate the sort of blaze resulting from the ignition of celluoid to take an old photographic film, such as is sold in rolls and apply a match to it. The combustion will be furious and fast, as though a pinch of gunpowder had been lit.

In the majority of cases, the operator of a moving picture apparatus is well surrounded by various members of the audience whose escape from his vicinity would certainly be prevented in case of accident. An outfit of this kind is less dangerous than the ordinary stereopticon with gas tank, if it is properly installed. The unnecessary risk which operators often run in their ignorance or carelessness is a menace to themselves and those onlookers who are virtually seated upon casks of gunpowder while the pictures are moving.

MISCELLANEOUS.

STRAY CURRENTS.

COST OF TELEPHONE SERVICE IN BOSTON.

The city of Boston pays over $100,000 a year for telephone service connected with departments.—Ex.

FENCE WIRES AS TELEPHONE CONDUCTORS.

The use of fence wires in Australian plains as telephone conductors is becoming general, and the farmers thus commonly communicated over distances of 7½ to 12½ miles.—Ex.

CAPITAL PUNISHMENT BY ELECTRICITY ADOPTED IN MASSACHUSETTS.

The State of Massachusetts will hereafter put its condemned criminals to death by the electric current, instead of by the hangman's noose. The Governor of that State lately signed a bill of the legislature making provision for the change.—Ex.

AN ELECTRICALLY HEATED FURNACE FOR POTTERY.

The London Electrical Review is authority for the statement that an English firm has developed an electric process for the production of ceramic wares which yields very superior results. Briefly described, it consists in the employment of photography for the production of the designs, and an electric furnace of special design for burning in the designs, the photographs being covered with a special glaze. The excellence of the product is stated to be due chiefly to the method of burning, the electric furnace permitting of being kept under complete control.—Ex.

NEW METHOD OF STORING LIQUID ACETYLENE.

A great advance in acetylene lighting has been made, as a perfectly safe method of storing liquid acetylene has been discovered. This will enable the use of gas holders, which are the greatest source of danger, to be done away with, as the acetylene can be made at central stations, and liquefied as fast as it is made. The discovery consists in saturating kieselguhr with the liquid acetylene, of which it will absorb about four times its own weight. In spite of its analogy to dynamite, the mixture is perfectly free from all risk of explosion.—Ex.

TELEGRAPH LINES SHORT CIRCUITED BY SALT.

A very curious case of telegraphic disturbance is reported from Utah, where the Oregon short line lost six telegraph wires for a distance of eighty miles north of Ogden, Utah. It was found on inspection that the cross arms and insulators were heavily coated with salt varying from one-sixteenth to a quarter of an inch in thickness. This coating, when wet, taken in connection with the snow lying on the cross arms, formed a dead cross. During the middle of the day, when the sun was shining brightly, the salt appeared to dry out and the wires could be used to some extent. When the cause of the trouble was determined, an engine was started out equipped with a large hose which was used with hot water for washing off the coating. The salt was carried by the winds blowing over the Great Salt Lake, and as salt is a conductor of electricity the short circuiting of wires is easily explained.—Ex.

CHARMED BY THE ELEVATOR.

That electricity exercises a certain amount of fascination is shown by the following incident, taken from the New York "Sun:"

The porter of Mr. Newell's store, a haberdashery on Fifth avenue, in a fit of unwonted energy on Sunday forenoon made a visit to the building. He was surprised to find Philip O'Brien, who had been formerly employed by Mr. Newell as an errand boy, in the freight elevator, with his hand on the lever, ready to start upward, and as he could think of one explanation only for the presence of the recently discharged errand boy in a building supposed to be deserted and locked up, he charged O'Brien on the spot with being a thief. The terrified boy made a plunge and a dash, evaded his accuser, reached the door, and vanished into space.

The incident, magnified by the imagination of the faithful porter, was reported the next morning to Mr. Newell, who, in turn, reported it to Police Headquarters, with the result that O'Brien was arrested at his home. A false key to Mr. Newell's building was found in his pocket.

It appeared that the new electric elevator had exercised a strange fascination over him from the first day he saw it. He spent not only his leisure moments, but also much time stolen from his duties near it, coaxing the attendant into giving him a ride, or begging for one brief chance to handle the lever that regulates its movements. The desire to run it all by himself finally became so strong that he decided to get a key to the building.

The time that followed after its acquirement seemed to bring paradise back to earth. Almost every evening the boy spent in the building, making trips with the elevator, bumping it against the ceiling and dropping it to the floor, but always too happy to be conscious of the harm done to the cage and the machinery. The first few evenings he went alone, but later he took his younger brother along, and as time and practice brought a feeling of security, he invited favored friends to accompany him on private elevator excursions. All the time he felt deeply that the running of a first-class electric elevator beat any other game he could think of.

The size of that last bill for elevator repairs makes Mr. Newell inclined to believe the boy's story, and this inclination has been strengthened by the failure to discover any shortage in the stock.

THE SENSATION OF BEING SHOCKED ELECTRICALLY.

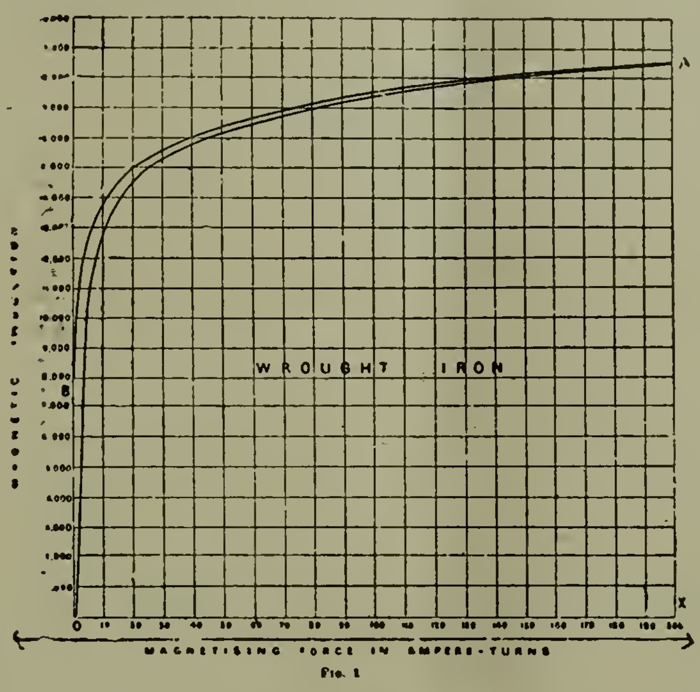
Dwight L. Clough, the electrician who was recently reported to have survived a shock from an electric current of 11,000 volts, received at the power house of the Buffalo & Lockport Railway, is so far recovered as to be able to tell how it feels to be struck by a strong current of electricity. When a reporter of the Buffalo "News" questioned him in regard to the shock, he said: "Well, in the first place, the report given out that a current of 11,000 volts passed through my body was erroneous. The current measure of the current was 1,000 amperes under a pressure of between 800 and 900 volts. You see the ampere is the measure of volume, while the volt is the measure of pressure. With this correction, however, it remains a fact that the chance of living after such a current goes through one is about one in 100. As to my sensations, I had none. I was filing a brush ring on one of the converters. I stood on a rubber mat to insulate myself, as the machine was running. Unnoticed by me, the mat slipped about, and in changing my position a little, I slipped with one foot into the well under the machine. That threw me against the machine, and my foot came in contact with the machine frame, completing the circuit. I saw a blinding flash which seemed to play about my wrists. There was an explosion. I was lifted from the floor an instant and then was hurled back. I was conscious all the time and knew what had happened, but I felt nothing. Apparently every nerve and function of my body except the brain was for the moment paralyzed. I lay for a few moments and then managed to get to my feet and attempted to get to the door, but I seemed unable to control my movements and fell again, this time losing consciousness. The next I knew was when I regained my senses for a time in my room in the hotel." Mr. Clough is badly burned about the hands, arms and ankles.

The largest electric light dynamo in Canada has just been installed in the new power house of the Ottawa Electric Co., near the suspension bridge, at the Chaudiere Falls. It is of the Westinghouse type with a capacity of some 10,000 lights.

ELECTRO TECHNICS.

ELECTRO MAGNETISM.

Wrought iron occupies the same position, magnetically, that copper does electrically. By working wrought iron at its point of saturation, one hundred thousand lines of force per square inch, we require about 91 ampere turns per inch length of the metal. In the following diagram the curves show wrought iron magnetized above the point of saturation. For each square centimeter of cross section the ampere turns per centimeter length can be obtained. For instance at fifteen thousand lines of force per square centimeter, amounting to about ninety-four thousand per square inch, twenty ampere turns per centimeter length are required, or about fifty ampere turns per inch length of the magnetic circuit.



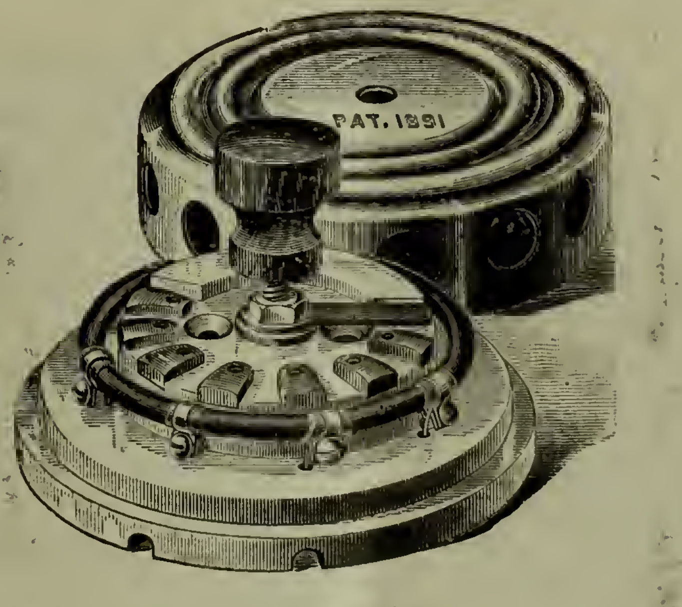
Magneto Motive Force Required for Wrought Iron.

REGULATING SWITCHES FOR MINIATURE LIGHTING.

The switch illustrated is really a rheostat. As shown, it consists of a circle of finely grained carbon, to which are connected at regular intervals the various steps of the switch. By turning the handle the resistance is either increased or diminished. If a battery and miniature lamps are connected in series with this switch the candle power can be regulated without the least difficulty. Switches of this description might be used on incandescent light circuits for running a night lamp. Of course, the number of carbon rings would have to be increased, but they would be very practical for the purpose above described.

MEASURING RESISTANCE.

To measure the resistance of a copper wire, carbon rod, incandescent lamp or German silver wire requires the employment of either a Wheatstone bridge or a method more or less scientific. By taking a pine board and stretching the wire composing the bridge between steel wire nails a rough form may be obtained which can be used for purposes of illustration if connected as shown in diagram. Stationery engineers or those who can use one hundred and ten volt current can construct a Wheatstone bridge by screwing four lamp receptacles down in place of the resistances and a fifth in the centre where the galvanometer is generally placed. On connecting the two ends, one and two, to the lighting circuit with the lamps on the galvanometer lamp will not glow. By using a fuse plug its candle power can be made to vary if inserted at A, B, C and D respectively.

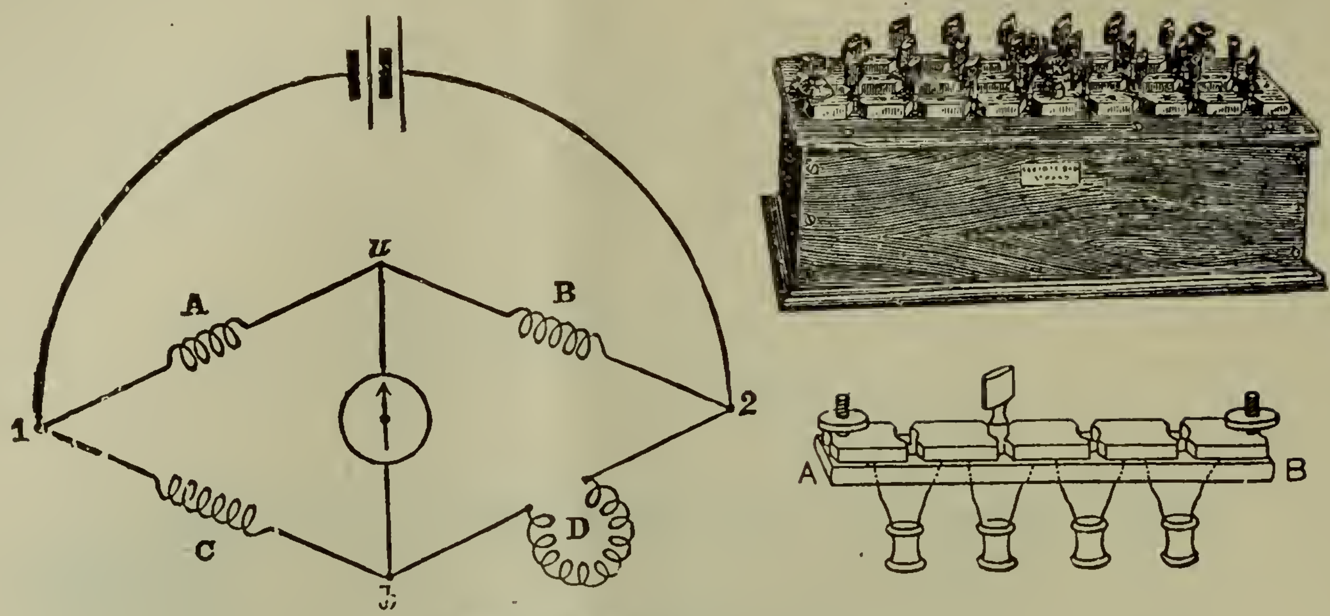


Regulating Switch.

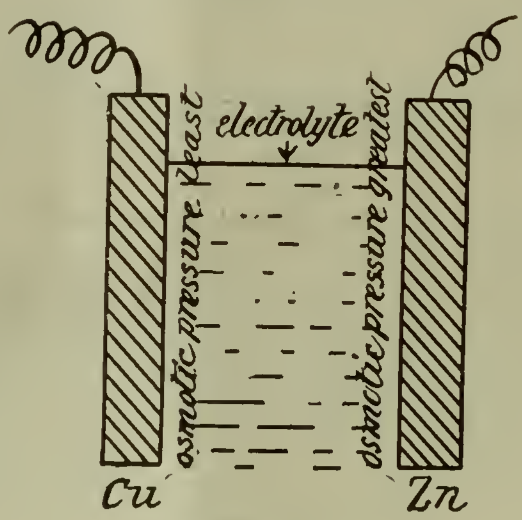
THE COPPER-ZINC BATTERY.

The statement of Dr. Oswald regarding the action occurring within a primary battery is based upon a new theory of osmotic pressure, or at least an old theory newly applied. When two elements are immersed in an electrolyte the osmotic pressure is least near the passive and greatest near the active electrode. In the case of a copper-zinc battery the zinc gives up its electrical energy to the copper, which conducts it away. The potential of the copper is higher than that of the zinc, but in spite of that

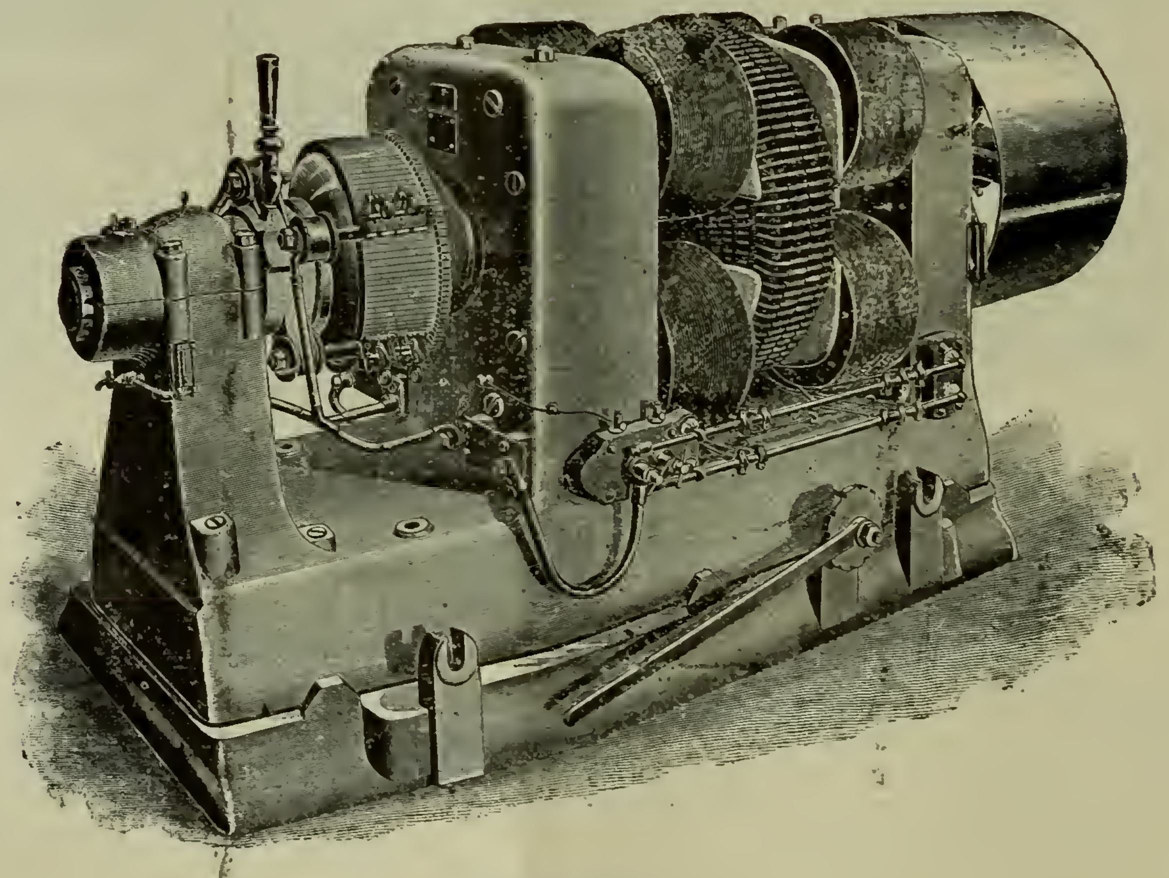
current flows through the outside circuit back to the zinc instead of leaping through the liquid. According to an authority the passage of a liquid or gas through membraneous diaphragms is called osmosis. On this basis osmotic action with reference to the above metals is in perfect harmony with the potentials they generate.



Method of Measuring Resistance.



Copper Zinc Battery.



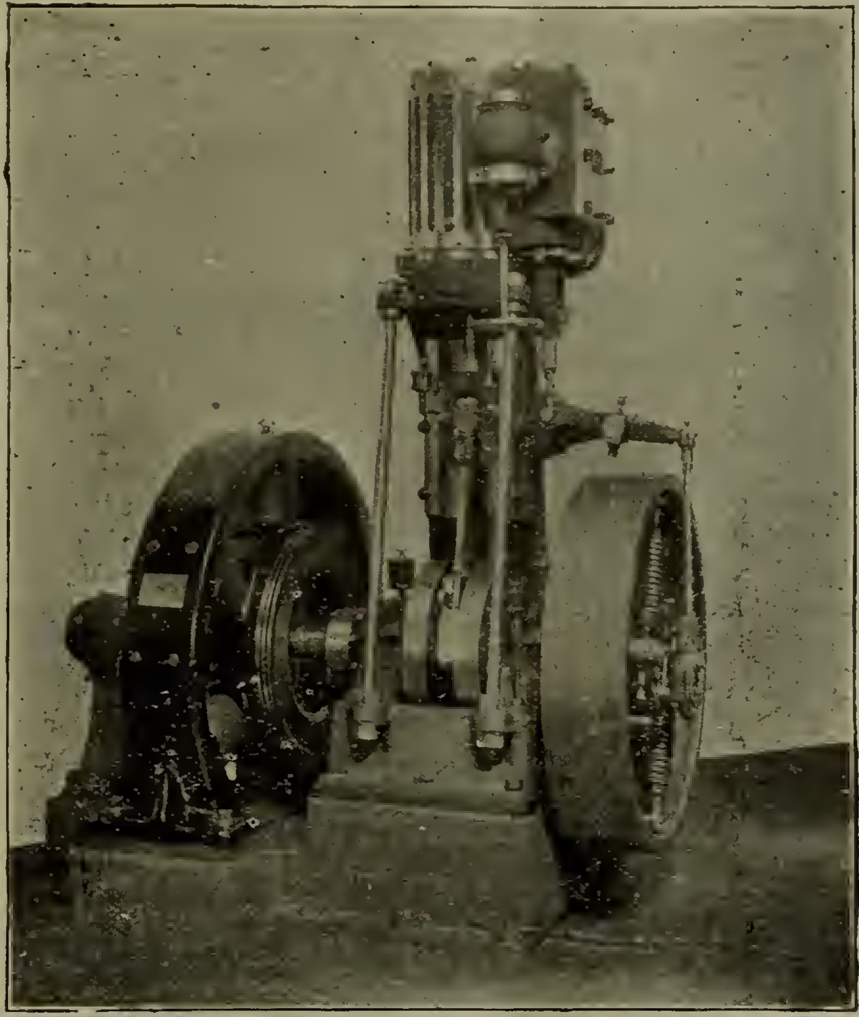
Disk Armature.

THE DISK ARMATURE.

The disk armature possesses some qualities which render it superior to the ring or drum. One of the most remarkable in existence, possessing no iron core, is that of the Desrozier machine. The two classes of disk armatures are represented by one in which the coils lay on the side as in an alternating current machine and in the other type the windings overlap and give continuous currents. The new and old Brush armatures do not differ materially from each other. The lines of force enter at one circular face and pass out at the other. The advantage of this type is due to the full employment of the greatest length of the

turn, whereas in the ring armature the inside wire is totally dead. About twenty-five per cent. only is dead in the disk type, fifty per cent. in the ring and thirty per cent or more in the drum.

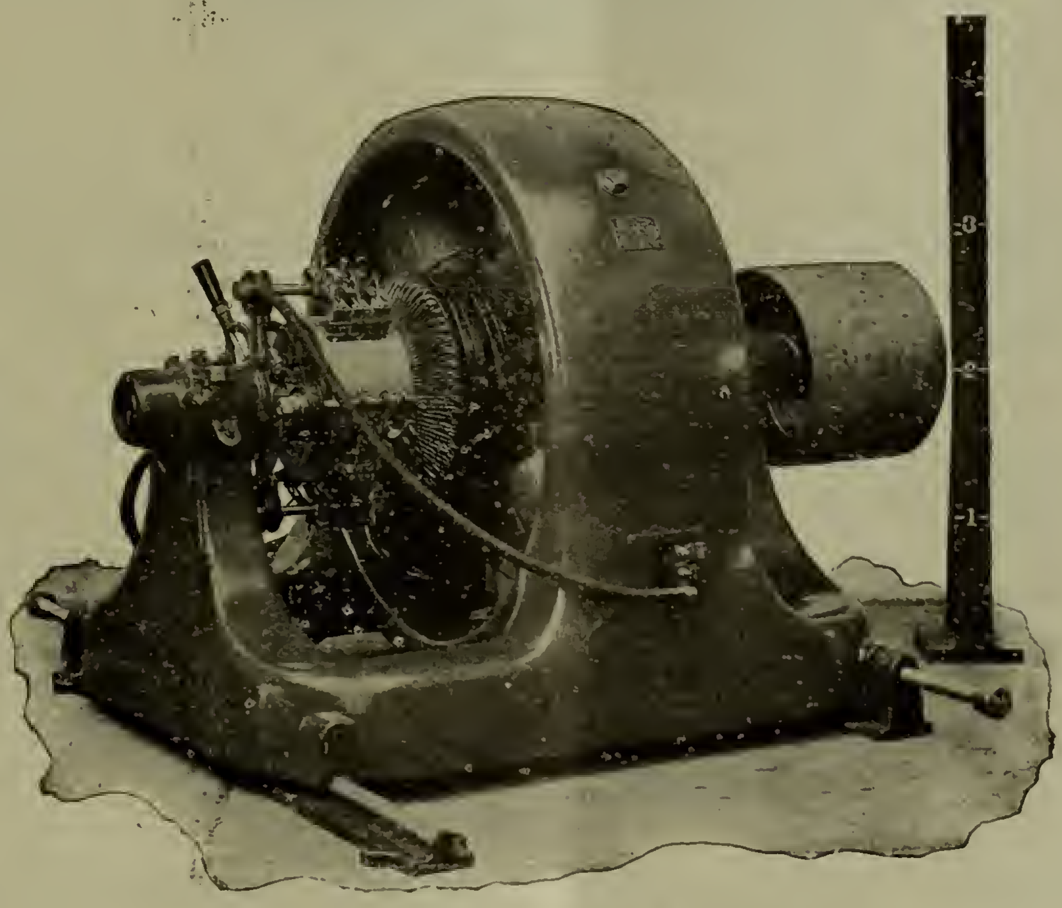
for the lines of force as one possessing curved lines at all points. As far as the weights of metals are concerned, lightness seems to be a little in favor of the octagonal form, but this is far out-balanced by the increased leakage. In the various types shown in the illustrations one direct connected and two other generators representing the polygon and circular form of field, the design is necessarily high class, but there is more cramping for room in the octagonal frame than in the circular. The habit of using octagonal shapes arose in earlier days, when cast iron was generally employed. The freer use of cast steel has changed the practice sufficiently to bring into existence a newer and better shape.



Circular, Multi-Polar, Form of Field Frame.

FORMS OF FIELD FRAMES.

The various forms of field frames designed for multipolar machines have been the subject of considerable criticism in engineering circles. The two most noticeable types are the octagonal form of frame and the purely circular. The octagonal form of frame means a four-pole dynamo, but it possesses the disadvantage of having corners and abrupt bends which cannot be as easy a passage



Circular, Multi-Polar, Form of Field Frame.

TRANSMISSION OF POWER.

THE SNOQUALMIE FALLS POWER PLANT.

The above company, Charles H. Baker, president, of Seattle, Wash., announce the completion of one of the most remarkable hydro-electric projects in the annals of American engineering—the harnessing and transmission electrically of the water power of the famous Snoqualmie Falls cataract (height 268 feet) to the industrial centers of Puget Sound. The hydraulic works and the thirty-mile aluminum transmission lines, supplied by the Pittsburg Reduction Co., have been completed, and the electric machinery from the Westinghouse Co. is now assembling. The service will be over two separate pole-lines, carrying four independent 25,000-volt circuits to insure uninterrupted service, and will be adapted to 2,000 volts for service to the electric lighting systems and motors, and other voltages as may be required mechanically or chemically. Six thousand horse-power in 1,500 horse-power units is the initial capacity of the plant which will be available on the above date from the company's power stations in Seattle, Gilman, Renton, and Snoqualmie. The company has also under consideration the application of Tacoma industrial concerns for power service, and a distributing station in that city will be an early feature.—American Manufacturer.

ROENTGEN RAYS.

COAL AND ROENTGEN RAYS.

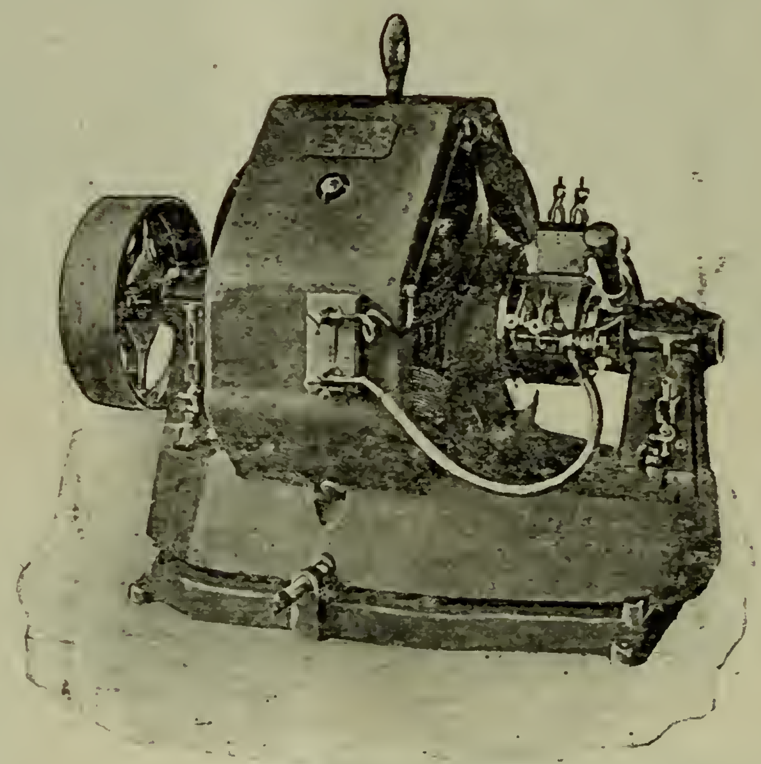
The proposal to examine coal by means of the Roentgen rays comes from France, and has often been repeated. Recently again by C. D. Haskins, of Philadelphia, who suggested that the heat value of a coal depended essentially upon its percentage of mineral impurities which could be ascertained by means of the X rays. But there is no such simple law. The chemical composition and the moisture are very important factors. Further, as Ferdinand Fischer points out in the "Zeitschrift fur Anfiewandte Chemie," various modifications of carbon are differently permeable to the rays; everybody knows that the diamond is practically opaque, and that real diamonds and paste can be distinguished in this way. The various mineral impurities of coal, gypsum, pyritese, slate, carbonates, etc., likewise differ very strongly in their transparency to the X rays. Fischer selected samples of peat, coals from various collieries, good and poor, anthracites, etc., examined them with a Roentgen apparatus, and analyzed them and determined their caloric value. The Roentgen examination proved quite unreliable, even when the coal was ground to a powder. Yet the rays might help in sorting coal from the same seam or gallery, if that be worth the trouble.—Ex.

ELECTRICAL MEASUREMENTS.

THE MEASUREMENTS OF INDUCTANCE.

Of the various electrical measurements which serve in the electrical testing laboratory, the measurement of the inductance (the exact electrical analogue of the moment of inertia of a rotating wheel) of a coil of wire, is perhaps the most unsatisfactory. Mr. H. Martienssen (Wiedemann's Annalen, 1899, No. 1) has improved the little known method of Puluj for measuring inductance by means of alternating currents. The method of Puluj was devised independently by Prof. S. T. Moreland and reported to Section B at the Boston meeting of the American Association. The method, in its simplest form, is to connect two circuits in parallel between inductance by rent mains and adjust non-inductive resistances until the currents in the two branches are in phase, when the inductances in the two branches are directly as the resistances. To show when the currents are in phase an instrument called a phase indicator is used. This instrument is essentially a small induction motor without iron. It consists of two small coils with their planes vertical and at right angles to each other, surrounding a suspended aluminum or copper rod. These coils are connected, one in each circuit, and when the two currents are not in phase with each other the suspended rod is deflected. Martienssen modifies the instrument by winding one coil with two strands of wire, each strand being provided with separate terminals. One of these strands he connects in circuit, as before, and the other constitutes a secondary coil, in which a current is induced by the current in the primary strand. This induced current is sensibly in quadrature with the primary current, and by the use of an adjustable non-inductive resistance in this secondary circuit the instrument may be used, according to Martienssen, for the accurate measurement of much smaller inductions.

Puluj's method, as modified by Martiessen, is a zero method; it requires only a single adjustment; it does not require harmonic electromotive force, nor does the frequency of the E. M. F. need to be known; and it gives accurate results for inductances ranging from



Octagonal Form of Field Frame.

a few hundreds to many millions of centimeters. In short, we seem to have at last a feasible laboratory method for the accurate measurement of inductance.—W. S. F., in "Science."

CHARGES FOR ELECTRICAL POWER.

A great reduction in the cost to consumers of electrical power in Europe, in some instances has caused a reduction of 80 per cent. This subject has been brought before many electric companies but we believe, notwithstanding all arguments, concerns stick to old schedules.

"At a recent meeting of the International Society of Electricians, M. Pellissier presented some interesting details regarding the cost of electricity in certain towns in Europe. At Brussels, the average price per kilowatt-hour is 69 centimes. The legal rate is 70 centimes, less a reduction of 20 per cent. in the case of consumers of more than 3,500 francs' worth of electricity per annum. At Berlin the price is 70 1-2 centimes, less a percentage of from five to fifty per cent. Public lighting is paid for at the rate of 50 centimes, less certain reductions. The Rhine Falls Company (Compagnie des Chutes de Rhine), at Reinfelden, charges 50 centimes per kilowatt-hour, with reductions reaching to 80 per cent. The following table gives the names of the various cities under review, with the average price per kilowatt-hour:

Cambrai	1.20	per kilowatt-hour.
Altona	1.20	"
Breslau	0.80	"
Frankfort	0.80	"
Havre	0.80	"
Berlin	0.70	"
Brussels	0.70	"
Hamburg	0.70	"
Munich	0.70	"
Nuremburg	0.70	"
Strasburg	0.70	"
Birmingham	0.70	"
Liverpool	0.70	"
Saint Etienne	0.70	"
Edinburgh	0.60	"
London	c.80 to 0.50	"
Nancy	0.60	"
Reinfelden	0.50	"
Manchester	0.20	"

The price of power will some day be fixed by law. With dollar gas and Welsbach burners the great majority cannot afford to light their homes by electricity. A public franchise calls for a minimum price of current. The general public will have little cause for complaint in the near future.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING FEB. 28, 1899, $51,033.

New York, N. Y., Feb. 28, 1899.—The following exports of electrical material and machinery are from the port of New York for the week ending this date:

Argentine Republic—One hundred and seventy-three packages electrical material, $7,878.

Antwerp—Fifteen cases electrical material, $1,795; 1 case electros, $15.

Alexandria—Two cases electrical machinery, $58.

Africa—Fifteen packages electrical material, $460.

Belfast—One case electrical material, $33.

British West Indies—Nine cases electrical material, $174; 11 packages electrical machinery, $10.

British Possessions in Africa—One hundred and twenty packages electrical material, $9,134.

Cuba.—Twenty-five cases electrical material, $1,163.

Central America—One package electrical machinery, $10.

Chili—Three cases electrical material, $307.

French Possessions in Africa—Thirteen cases electrical material, $1,479.

Glasgow—Nine cases electrical material, $640; 1 case electrical machinery, $93.

Hamburg—Four cases electrical material, $2,390; 23 cases electrical machinery, $2,316.

Havre—Eighteen cases electrical material, $707; 24 packages electrical machinery $234.

Liverpool—Nineteen packages electrical machinery, $877; 101 packages electrical material, $2,853.

Liege—One case electrical machinery, $255.

London—Forty-five reels electric cable, $12,870; 11 cases electrical machinery, $888.

Madrid—Two cases electrical material, $214.

Marseilles—Seventy-four cases electrical material, $1,053.

Munich—One case electrical machinery, $160.

Mexico—Thirty-two cases electrical material, $985.

New Zealand—Twenty-one packages electrical material, $585.

Porto Rico—Twenty-two cases electrical material, $1,097.

U. S. of Colombia—Twenty-seven packages electrical material, $300.

TELEPHONE CALLS.

Fremont, Iowa.—Farmers' & Traders' Telephone Co. has been incorporated by Ernie Lyon, R. W. Moore and J. B. Krout. Capital stock, $3,000.

Pulaski, Va.—Radford Telephone Co. has been incorporated by D. D. Hull, Jr., B. Laughon, George M. Holstein and B. F. Garnett, to operate a telephone exchange. Capital stock, $5,000.

Chillicothe, O.—The Home Telephone Co. has increased its capital from $25,000 to $40,000.

Lebanon, Tenn.—Lebanon Telephone Co. has been incorporated by J. B. Cowan, William Odum, N. G. Robertson, D. Johnson and A. M. McClain, to construct and operate a telegraph line. Capital stock, $5,000.

Sauk Rapids, Minn.—Sauk Rapids Telephone Co. has been incorporated by F. W. Sprague, W. S. Dean, W. A. Barto and W. O. P. Hilsdale. Capital stock, $10,000.

Hopewell, N. J.—Hopewell Telephone and Construction Co. has been incorporated by John N. Race, Theo. A. Fierson and David L. Blackwell to carry on a telephone business. Capital stock, $3,000.

Decatur, Miss.—The People's Telephone Co., incorporated by E. B. Partin, F. N. McMullan, F. O. Horne, L. B. Day and J. W. Gilespy to operate telephone lines. Capital stock, $5,000.

Baltimore, Md.—The Home Telephone Co. contemplates the extension of its system.

Smithville, Tenn.—The Smithville Telephone Co. has been incorporated by R. L. Cautrell, T. J. Patten, W. W. Parker, W. R. Parker and others. Capital stock, $1,000.

Orange, Va.—The Orange Telephone Co. contemplates extending its line from Parker's Store to Fredericksburg.

Charleston, S. C.—The Gordon Telephone Co. will hold a meeting March 27 to consider advisability of increasing its capital stock from $50,000 to $100,000.

NEW INCORPORATIONS.

Washington, D. C.—The National Electric Co., incorporated with H. B. Merrick president, for the manufacture and sale of electrical supplies of all kinds. Capital stock, $25,000.

Plainfield, N. J.—Chase Electric Construction Co. has been incorporated by Frederick F. Chase, Hattie T. B. Chase, Louis T. B. Chase and Juliette Chase to carry on a general electrical business. Capital stock, $5,000.

East Orange, N. J.—Bullock Electric Manufacturing Co. has been incorporated by George Bullock, James W. Bullock, Joseph S. Neave, Stephen R. Burton and James B. Dill to manufacture electrical machinery of all kinds. Capital stock, $500,000.

Glencoe, Minn.—Glencoe Electric Light Co. has been incorporated by B. F. Allen, E. E. McIntire, W. C. Russell and G. K. Gilbert. Capital stock, $8,000.

Princeton, N. J.—Princeton Electric Works has been incorporated by Charles S. Robinson, Frederick Fisher and Harvey L. Robinson; electric light company. Capital stock, $100,000.

Grand Island, Neb.—The Grand Island Gas Co. has been incorporated by B. B. Hensiger, N. S. Durnin, Heyward G. Leavitt, A. D. Abbott; erection or purchase of gas or electric light works. Capital stock, $150,000.

Canajoharie, N. Y.—Montgomery Electric Light and Power Co. has been incorporated by A. G. Richmond, E. B. Burnap and James M. Cook. Capital stock, $25,000.

East Rutherford, N. J.—Rutherford and Suburban Electric Light & Gas Co. has been incorporated by Cornelius Fitzgerald, Andrew L. Fennessy and William E. R. Smith to supply electricity for light, heat and power. Capital stock, $200,000.

Rochester, N. Y.—Rochester Electric Motor Co. has been incorporated by G. W. Davidson, John Buckley, E. F. Davison, Ella M. McDonald and F. C. Kimmel; electrical supplies. Capital stock, $10,000.

Utica, N. Y.—Johnson & Morton, incorporated by M. H. Johnson, W. H. Morton, G. G. Williams and Henry G. Hatfield to carry on an electrical engineering and contracting business. Capital, $10,000.

Pendleton, Ind.—Pendleton Water & Light Co., incorporated by J. H. Brown, George E. Mayer and B. O. Mayer, to operate waterworks and electric light plant. Capital stock, $5,000.

POSSIBLE INSTALLATIONS.

Tarboro, N. C.—The mayor may be addressed concerning proposed erection of electric light plant.

Houston, Tex.—The Citizens' Electric Light plant building is to be reconstructed at a cost of $150,000.

Wenonah, N. J.—An electric light plant is to be established.

Marianna, Ark.—An electric light plant will be established.

Leitchfield, Ky.—The Union Electric Light Co., of Schenectady, N. Y., has been granted a franchise for furnishing lights for Leitchfield.

BUSINESS CHANGES.

Sturgis, S. D.—The Sturgis Electric Light & Railway Co.'s electric plant has been purchased by Sam Oliver, of Rapid City, who will immediately take charge of same.

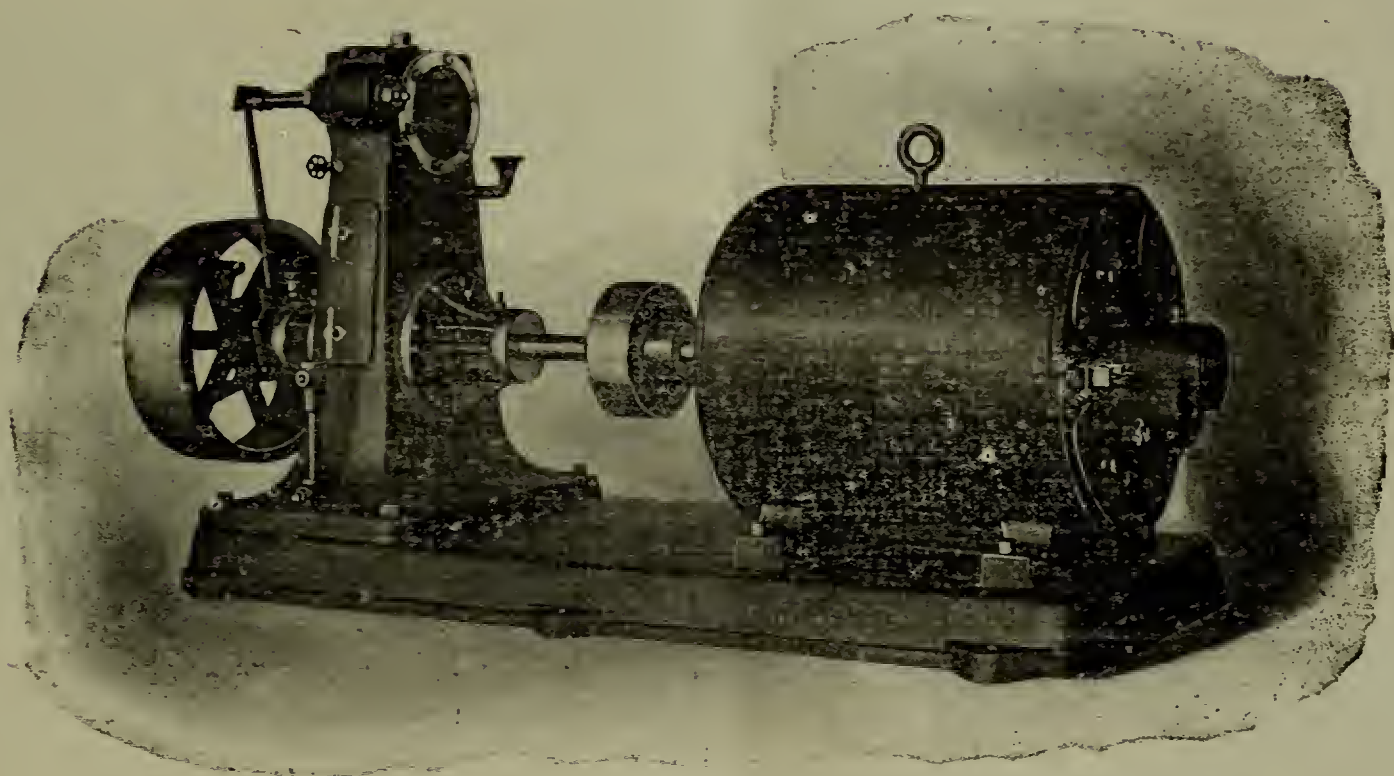
Chicago, Ill.—The Cass & Aaron Co. has changed its name to the Aaron Electric Co.

Chicago, Ill.—The Victor Electric Co. has increased its capital from $6,100 to $16,000.

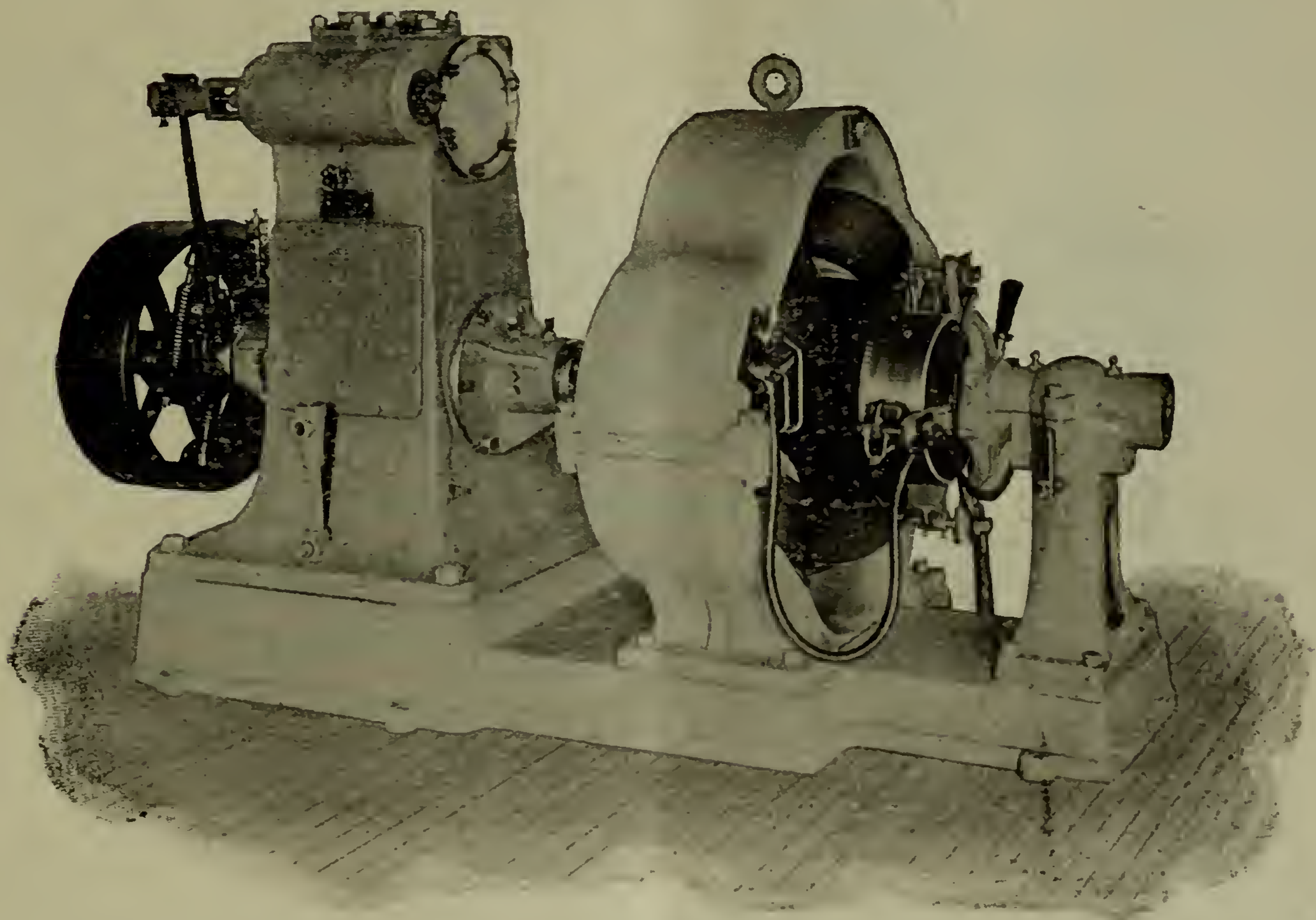
The Electrical Age.

VOL. XXIII—No. 11 NEW YORK, MARCH 18, 1899 WHOLE No. 618

ELECTRIC LIGHT AND POWER.



High Speed Case Engine, Direct Connected.



Plant for Shipboard With Case Engine.

COMPACT ELECTRIC LIGHT PLANTS.

For shipboard, limited floor space on land and train lighting, the utilization of a small, self-contained steam engine and dynamo gives all that science can produce. The question on shipboard, particularly in the naval service, is largely

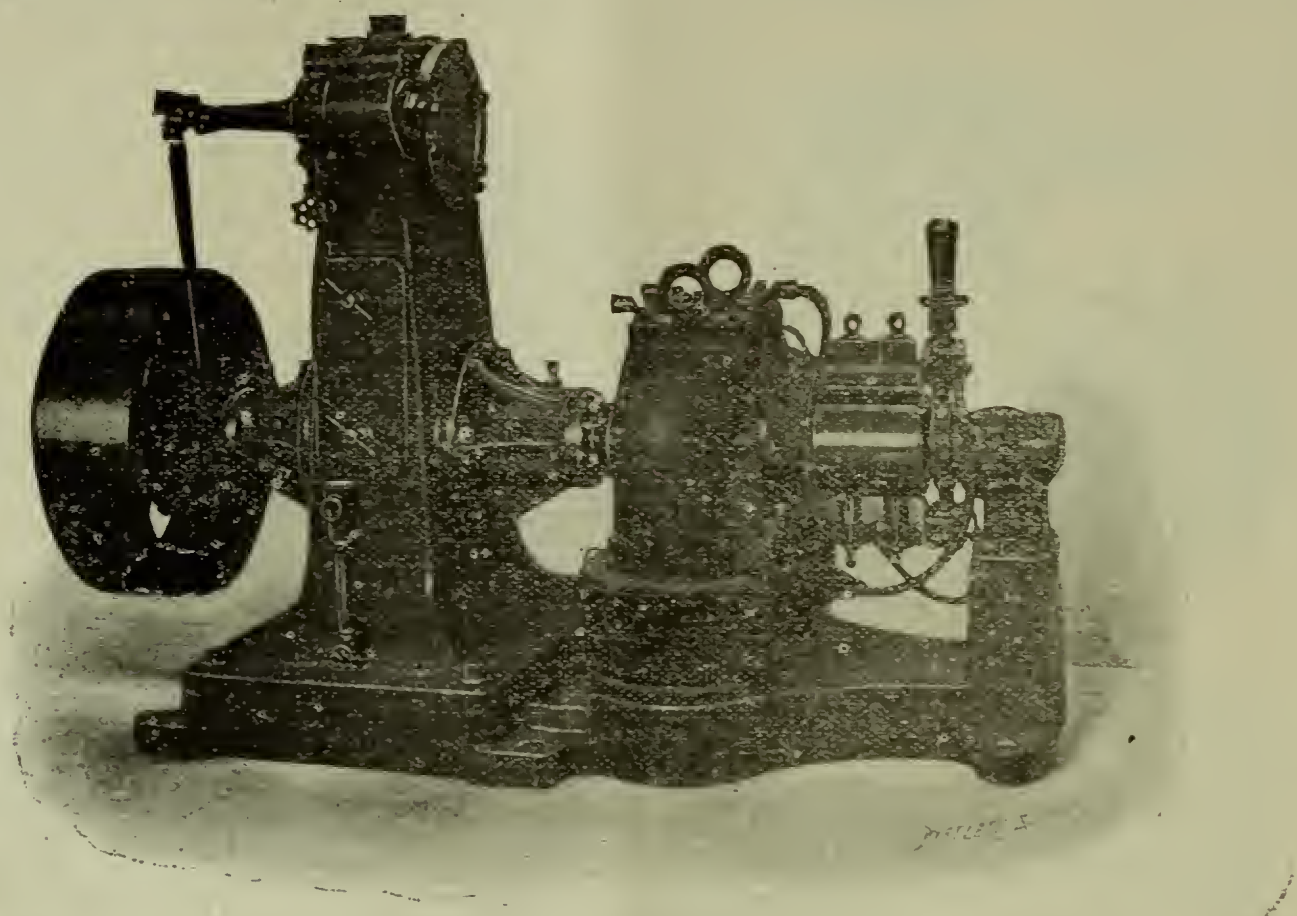
one relating to the weight of the outfit and for this reason the design of both dynamo and engine is limited by severe mechanical and electrical restrictions relating to their form and weight.

Considering the problem from a purely mechanical standpoint the weight limit is only reached when we touch upon the speed limit. In other words, in steam engineering as well as electrical engineering, doubling the speed means almost a fifty per cent. reduction in the general proportion and consequently the weight of the engine. The formula for horse power, if considered for a moment, shows us that pressure multiplied by length of stroke multiplied by number of revolutions per minute multiplied by area of piston represents variable quantities, increased or diminished at the will of the designer.

With a fairly large area of piston and a high speed of reciprocation the resultant horse power would be much larger, weight for weight, for the smaller engine. In the construction of a dynamo for the same purpose, direct connected to a steam engine, the weight factor can only be considered from a magnetic standpoint. In order to increase or diminish the speed, whereby the weight of the machine is diminished or increased, it is necessary to vary the lines of force in order to obtain a fixed electric motive force. Therefore, as electric motive force means lines of force with a fixed speed, and lines of force means cross section of iron or steel, doubling the speed of the armature would call for a fifty per cent. reduction in the magnetic circuit and roughly speaking, a thirty per cent. reduction in the weight of the generator.

It is almost axiomatic in steam and electrical engineering that an increase in speed means a light weight machine, a decrease in speed the very reverse. For shipboard purposes, therefore, in which lightness of weight is the first consideration, a high speed steam engine is necessary. The generator can be greatly reduced in weight by the employment of many poles, an armature of large diameter, and consequently a high peripheral speed. Unless a multipolar generator is carefully designed it is apt to be heavy and unsatisfactory and relatively worse than a bi-polar machine for the same output, as far as weight is concerned.

But careful adherence to the laws of design, regarding both steam engine and dynamo mean a fairly high speed, such as would be consistent with mechanical strength, and a reduction in weight per horse power to about one hundred and sixty pounds in fifty light plants and of course less in larger equipments. The above outfits are installed by the New Britain Machine Company, of New Britain, Ct.



Small Lighting Plant, Readily Transportable.

AUTO-MOBILES.

ELECTRIC CABS FOR PLEASURE AND PROFIT

The generation of electricity for the purpose of supplying electric cabs or automobiles with a store of power has become a firmly established feature of electrical engineering practice. The substitution of the electric vehicle for the horse and carriage will soon be a change noticeable on the highways, in the parks and on many of our greatest avenues.

Electric Cab for City Work.

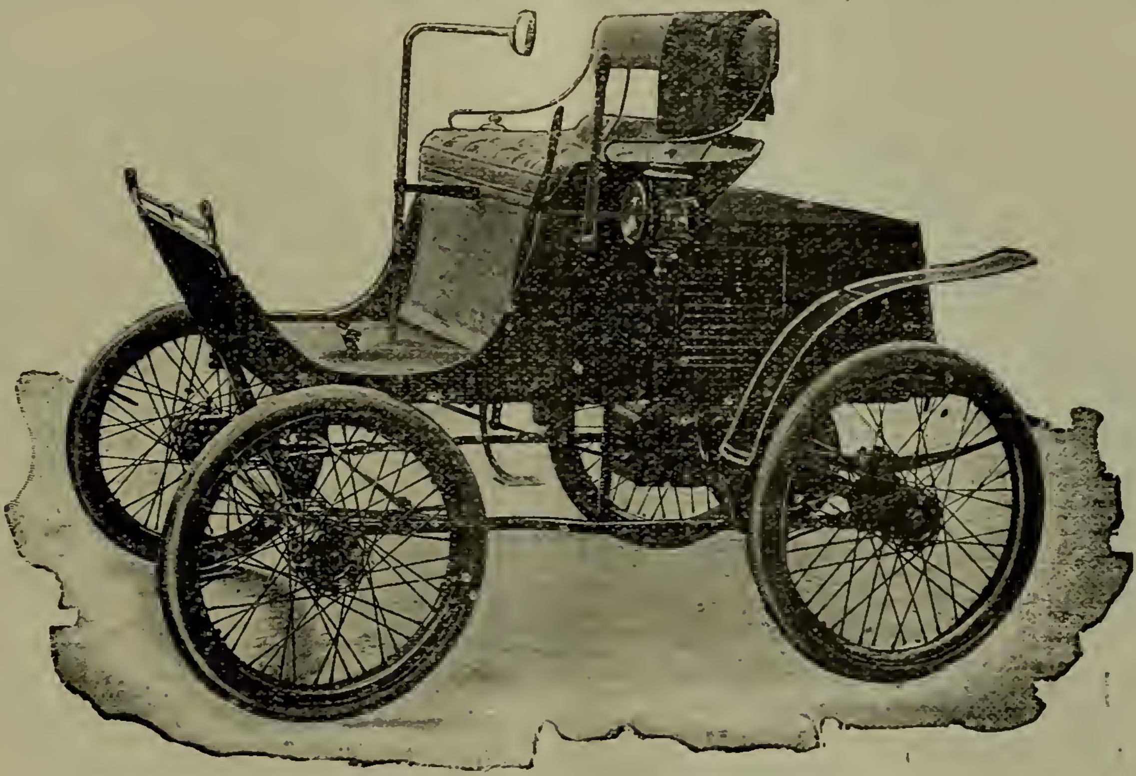
In exchanging the horse for the motor it will be necessary for the proprietor of an automobile to arrange for his power supply. In many cases a private electric light plant, consisting of steam engine and dynamo or gas engine and dynamo, will be quite sufficient. But to those to whom the care and responsibility of machinery of this description is too great to be considered the central station will be called upon to give their quota.

The manipulating devices of an electric cab are not apt to get out of order because of the fact, as shown in the illustra-

tion, that their automaticity is not dependent upon either an electro magnetic device or a mechanical arrangement dependent upon certain springs or catches. The connections leading to the governing devices are simple and permanent and the transference of batteries from time to time calls for little expert knowledge.

Original outlay and annual cost of maintenance would not exceed one thousand dollars the first year and three hundred dollars the second.

To those so situated that an electric vehicle can be taken care of by an electrician, whose duty concerns an electric light plant as well, the care and maintenance item might



Private Automobile.

In consequence of all this it is well to expect a rapid development in the electric vehicle trade sufficiently great in the near future to make the price of an automobile compare favorably, as far as first cost is concerned, with that of a fall below two hundred and fifty dollars per annum, the vehicle being in constant use. The proposed use of electric vehicles for trucking will develop into a most extensive and profitable business if properly conducted.

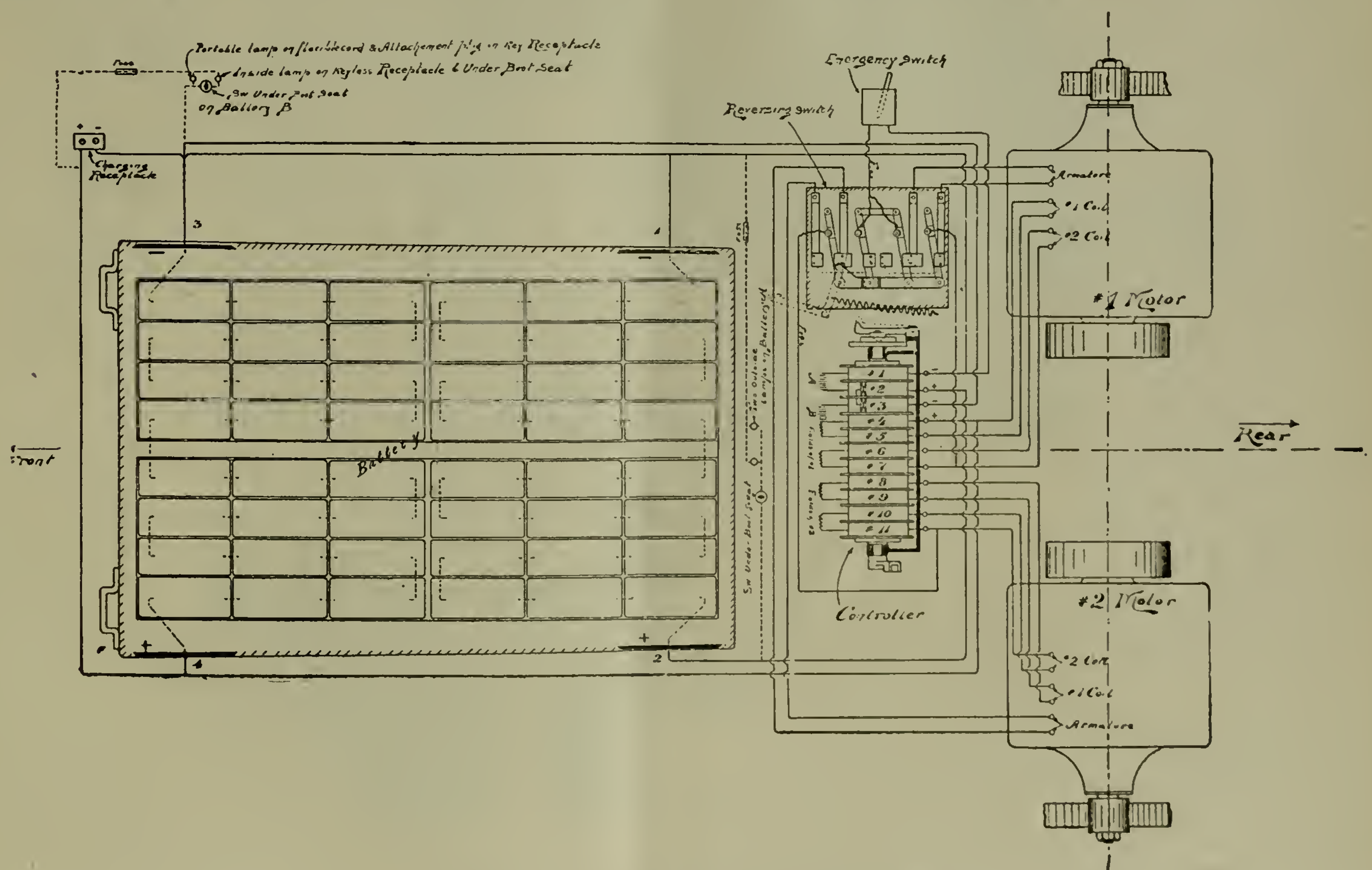


Diagram of Connections, Governing Device, Etc.

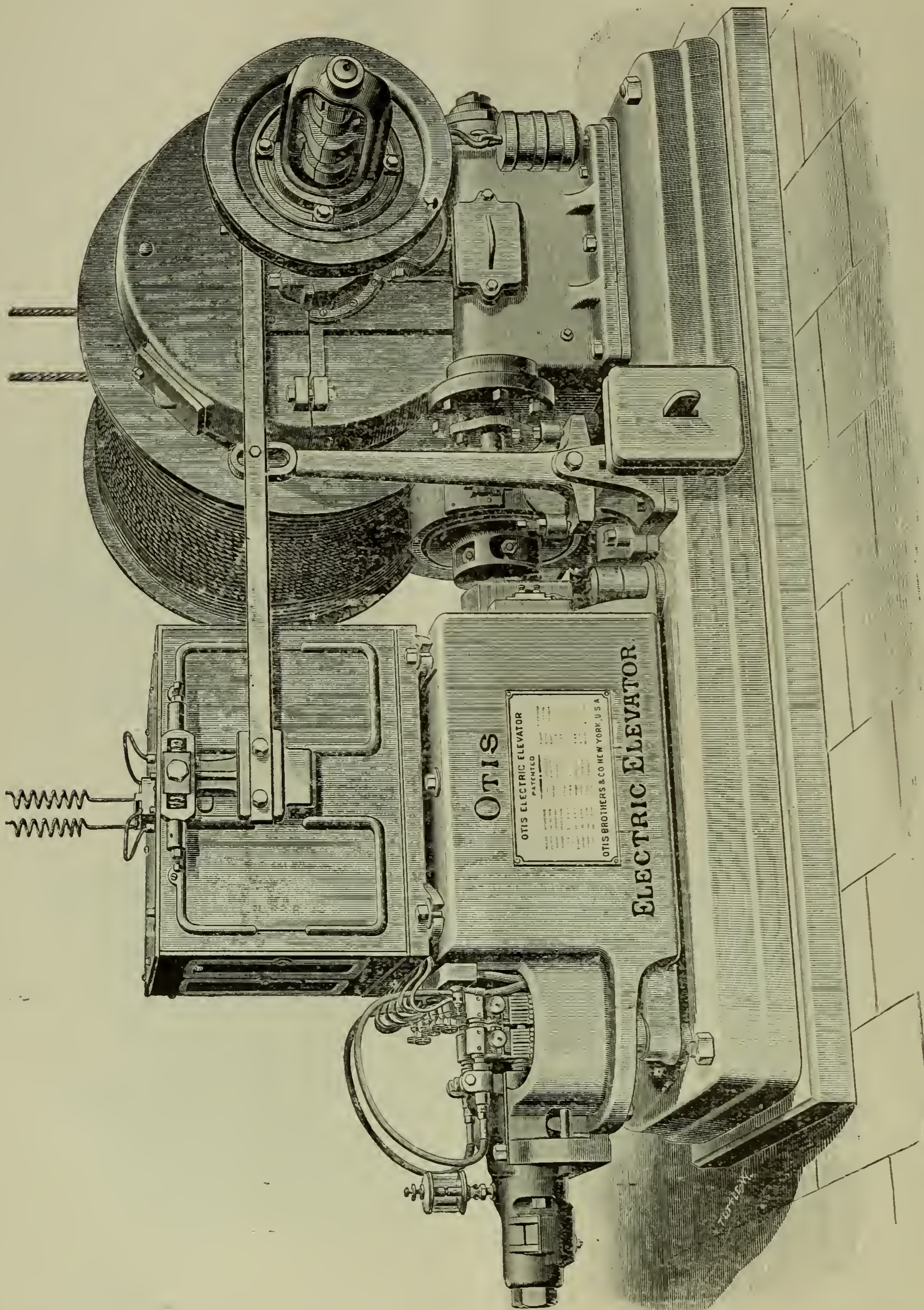
spanking team and carriage. The constant expense of horse, carriage and driver are dispensed with by the substitution of an automobile. It compares so well with the bicycle that in proportion to their relative costs and advantages they are as cheap for four wheel travelling as the bicycle is to pedestrians.

Our London contemporary, the "Electrical Review," states that Mr. W. H. Preece, C. B., F. R. S., having attained his sixty-fifth birthday, retired from the position of engineer-in-chief and electrician to the Post Office, but it is believed that his services will be retained by the Postmaster-General as consulting engineer.

ELECTRIC ELEVATOR DATA.

The construction and care of electric elevators and hoists represents a peculiar field of occupation at present duly recognized. A shunt motor on a constant potential circuit operating an electric elevator is largely governed in its design by the requirements of speed, weight and frequency of use. Practical experiments have shown that the horse power required to run a hoist is increased at least seventy per cent. than that actually utilized. The addition is due to friction. A change may take place, depending upon the nature of the gearing, whether it be spur or worm, or something else.

If the average loss due to friction is calculated as being equal to fifty per cent, the horse power of any motor required for hoisting or elevator work would equal weight in pounds per minute, multiplied by speed per minute, divided by 16,500. As an example, in order to lift nine hundred pounds eighty feet a minute in a vertical elevator shaft, the cage being counter balanced, preferably on the drum, the horse power required would be equal to nine hundred times eighty divided by 16,500, equal to about four and one-half horse-power.



Standard Electric Elevator. Otis Construction.

If the cage is counter balanced but the shaft is inclined, the case being almost equivalent to that of the Jungfrau railway or the Otis inclined railway in the Catskills the product of the weight and speed is multiplied by the sine of the angle before being divided by 16,500.

To lift nine hundred pounds eighty feet a minute, the cage being counter balanced on an incline of forty-five degrees, we have the horse power of the motor equal to nine hundred times eighty times seven tenths divided by 16,500.

(Continued on page 154.)

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CONTENTS:

INVENTION AND CIVILIZATION.

To say the least, these words are almost synonomous. Without civilization there is no invention and conversely, without invention there is no civilization. The last statement may be subject to criticism, but reflection will show that what we call modern progress mainly refers to the general use of telegraph, telephone and other applications of electricity and mechanics in the arts, sciences and industries.

Chaldean civilization differed somewhat from that of Greater New York. In comparison with what we regard as civilization to-day that of ancient Egypt, Persia, Turkey and the Roman empire was a reign of terror and blood. Buildings were reared in those days as well as these, but few, if any, labor saving devices were employed and a knowledge of the arts and sciences was so limited that a public school graduate of 1899 passes through a greater intellectual experience and is in possession of more useful knowledge than the most famous of ancient philosophers.

The spirit of this age is one of originality. It is so marked in its influence upon literature and science that it seems as though mankind were endowed with a new soul. Originality in literature is manifested in many ways known to the student of belles letters, but with those gifted with more scientific information the bent of mind betrays itself by a series of new devices.

With a better comprehension of the principles of mechanics the steam engine came into view, due to the perseverance and genius of Watt. A variety of applications was then made on land and water of this machine, giving us the steamboat of Fulton and the locomotive of Stephenson. Fifty years of intense activity followed during which time the cotton gin, weaving machinery and the sewing machine made its appearance.

As newspapers began to gain ground printing presses were improved, and, in the course of time, these vast and intricate devices were parallelled by improvements in watch making and machine shop practice. The telegraph and telephone, the transatlantic cable, the trolley car and electric light soon exerted an influence over a city's growth and prosperity which has marked this epoch as one of the brightest in the history of civilization. It cannot be said that civilization and invention are one but they are twin brothers moving hand in hand along the path of human destiny.

It is interesting to observe the effects of any specific demand upon any special field of occupation most influenced by it. Coal mining, at all times a laborious process, was at one time carried on in so crude a manner and with such risks to life and limb that annually hundreds of sacrifices were made by poor unfortunates, born and bred in this occupation.

The safety lamp of Sir Humphrey Davey acted as an efficient antidote to the dangers of fire damp, and with succeeding years a sytem of inspection and the use of labor saving machinery for drilling, excavating and transporting the precious fuel reduced danger to a minimum. In this respect the call for more machinery, the development of new inventions and the rising crest of that wave of originality now rearing itself over this country has placed it at the very front of all lands in practical invention.

Mechanical applications are now being fast knitted in with electrical machinery, the first being subservient to the second. The best of engines are employed in their stage of highest perfection to drive electric generators. Motors are being attached to the tools of large machine shops. Ventilation is secured in hotels and homes by electrically driven fans, and our surface roads and methods of personal communication are entirely electrical. The new century will dawn with its beginning representing a most exalted condition of mankind.

With a hundred years spreading out before us and the magnificent possibilities that exist in the way of future development it seems as if we will be unconsciously transported to a fairy land with aerial yachts, noiseless automobiles, wireless telegraphs and telephones and an artificial daylight at dusk. It would seem from this that invention and civilization are indeed only synonyms.

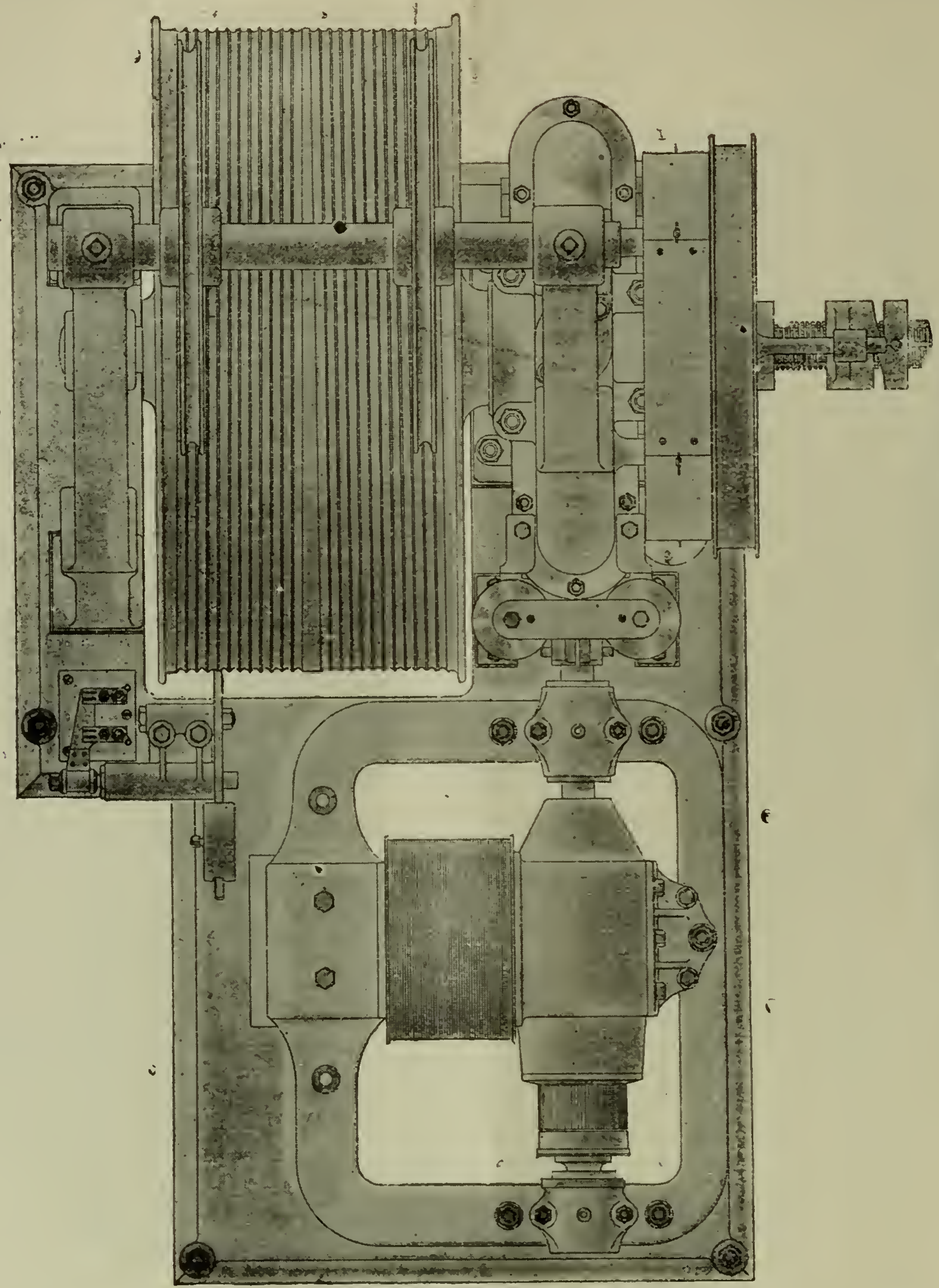
SPECIFIC INDUCTIVE CAPACITY.

According to Ayrton and Perry, the specific inductive capacity of hydrogen, a vacum and air are almost identical. According to the tests made the difference between air and hydrogen is about .0002 and the difference between air and a vacum .0015. These values are given for the purpose of showing how accurately scientific tests are made of these gases. It also serves to show that if a conductor carrying a current is surrounded by hydrogen instead of air or rested in a vacum the condenser effect would be the same, for practical purposes, in either case.

NEW USE FOR CALCIUM CARBIDE.

Aside from its use for generating acetylene gas for illuminating purposes, this substance has properties that may render it valuable for other industrial purposes. Lorchers, in Germany, has proposed its use for deoxidizing and carbonizing steel, for which purpose the analogous silicon carbide has been successfully employed in this country, and Caro suggests its use for the production of cyanide by heating it in a current of nitrogen and steam. If this last proposition should prove practicable on the commercial scale, it would prove highly important in view of the large and constantly growing demand for cyanides in extracting gold from low-grade ores.—Journal of the Franklin Institute.

or about three horse power; the sine of an angle of forty-five degrees of course being seven tenths. The general arrangement of the motor, drum and hoisting outfit complete is shown in the following illustrations.



Plan of Electric Elevator with Motor Laying Sideways.

ELECTRIC NOVELTIES.

AN ELECTRICAL BARBER SHOP.

A French electrical paper describes an electrical barber's shop recently fitted out in Paris with the most up-to-date appliances for performing the humble offices of the tonsorial artist. Electricity is resorted to exclusively, and is put to novel use. For example, hot water is obtained by passing the stream of a hydrant through a German silver tube in a soapstone case, the tubing being electrically heated, so that the water is nearly boiling when it passes out at the spigot. For the crimping of ladies' hair there is no longer necessity for recourse to the hot iron. For a long time the defects of this method of heating have been noticed, for the capillary artist sometimes forgets and leaves the iron in the heating apparatus too long, so that when it is used with blonde or brown hair, if it does not make a burn, it makes the hair red, which is even more disastrous. The new curling irons heat themselves. In the interior of the rods is a ferro-nickle wire, which can be brought up to the proper temperature, and will remain at this same temperature indefinitely. But it is in the cutting of the hair that electricity has produced the most complete revolution. The scissors have slowly given way to clipping machines, and these, in

VACUUM DRYING.

The English electrical journals briefly describe an apparatus said to be quite widely used by the leading electrical firms of Germany for the drying of the insulation of electrical coils, dynamo armatures, etc., at low temperatures by means of a vacuum. The apparatus consists simply of a cast-iron chamber closed by doors hermetically sealed with India rubber gaskets, and arrangements for obtaining a vacuum of 28 inches of mercury or more, and for heating the chamber proper by steam or hot water. At a very moderate temperature, about 95 degrees F., water evaporates more rapidly under this condition than at temperatures under atmospheric pressure high enough to injure the insulating properties of organic substances through carbonization. With a high vacuum it is stated that materials can be thoroughly dried at as low a temperature as 63 degrees F. It is said that English cable works have used a similar process for jute and paper insulated cables, as well as washed India rubber, for some time.—Journal of the Franklin Institute.

their turn, must disappear before an electrically-heated platinum wire, with which the hair may be burned off. The apparatus as described consists of a metallic comb, along one side of which is stretched the hot wire, and this is passed through the hair the red-hot wire burns it off neatly and smoothly, and at the same time seals up the ends in most approved fashion.

MISCELLANEOUS.

STRAY CURRENTS.

FRIGHT FROM LIGHTNING CAUSES DEATH.

William Steadman, a conductor on the Stratford avenue line of the Bridgeport Traction Company, dropped dead on the platform of his car from heart disease, aggravated by fright from a blinding flash of lightning.

A VALUABLE BATTERY "POINTER."

To prevent the acid of a battery from climbing and reaching the brass fittings: Dip the upper end of the carbons in melting paraffine till they are completely saturated for an inch with paraffine. Coat the upper end of the zincs with asphaltum varnish. Of course, the cells must be taken to pieces and the plates thoroughly washed and dried before treating them.—Ex.

THE BRUSSELS ELECTRICAL EXHIBITION.

The Belgian Society of Electricians will hold at Brussels next May a complete exhibition of the various uses to which electricity may be applied in the household. Besides appliances for illuminating purposes, there will also be exhibited small motors for operating dumb waiters, cleaning and polishing shoes, heating kitchens, cooking stoves, bath rooms and bath tubs, electric teapots, sad irons, domestic telephones—in fact, all appliances operated by electricity, with a view to the total suppression of the use of coal for domestic purposes. M. Emile Closset, 26, rue St. Jean, Brussels, may be addressed.—Ex.

ELECTRIC FIRING IN MINE WORK.

In some of the German collieries and especially the Mont-Cenis colliery in the West Dortmund District, excellent results have been obtained in shot firing with a magneto-electric machine and wire cables of a most primitive character; for example, the conductor from the machine to the shot in the dry mines, consists of nothing but a galvanized iron wire .039 of an inch thick for dry workings and insulated copper wire for wet ones. For insulation, the conductors for the current from the firing station to the shot are supported loosely in eyes cut in the sides timbers. Misfires with these machines are very few in number; for example, in firing 1,663 shots no misfires occurred. In another case, 548 misfires occurred out of the great total of 34,274 shots, or the misfires were in the ratio of 1.16 per cent. The cost of firing a shot in this way was found to be three cents against $1\frac{1}{2}$ cents for ordinary firing with safety fuses.—Zeitschrift fur Berg-, Hutten- und Salinen Wesen.—Ex.

TELEPHONING AROUND THE WORLD.

Thomas A. Edison is ready to build a telephone completely around the world. "So far as invention is concerned, the work is done. It is now a question for capital," said he in an interview recently. "I have had this scheme of a circumterrestrial telephone circuit under consideration since 1870. It involves a cable laid across the Atlantic Ocean, from New York to Southampton, probably, and after passing under the English Channel, by way of Paris, Berlin, Vienna and Constantinople, across Asia to Calcutta, India. Thence it would follow the Chinese coast to Bering Straits, where, crossing over to Alaska, it would run southward to San Francisco and thence back to New York." Mr. Edison thinks it would be impossible to transmit sound through a continuous 3,000 miles stretch of water, and hence would take advantage of the shoals always to be found sufficiently near the surface of the Atlantic here and there for the purpose. As for the money required, he is afraid to name the amount. That it would go into hundreds of millions—perhaps billions—is easy to be imagined, but, then, just fancy a familiar chat before breakfast with the Empress Dowager of China!

PRACTICAL EXPERIMENTS IN WIRELESS TELEGRAPHY.

Signor Marconi reports that he has succeeded in telegraphing without wires from Alum Bay to Bournemouth, England, a distance of fifteen miles, at the rate of fifteeen words a minute. He sent a thousand words a day, and the messages were easily read.

TELEGRAPHING WITHOUT WIRES.

A NEW KIND OF WIRELESS TELEGRAPH.

The other day at the meeting of the Vienna Gewerbeverein, Professor Zickler, an Austrian savant, reported on a new kind of wireless telegraphy which he has invented, and which, without doubt, is one of the most valuable contributions to the solution of the problem of wireless telegraphy, because while utilizing an electric phenomenon (first observed by Hertz) for the transmission of signs, he employs the invisible ultra-violet rays proceeding from a source of light, which rays have the property of setting free electric sparks at the receiving station. At the despatching station the effective rays are produced by the powerful arc light of a reflector which sends them only in the direction of the receiving station, so that the possibility of the signs being intercepted in any other direction of spaces is excluded. Another property of these rays, viz., their being absorbed by glass, is a means of preventing diminution of the cone of visible rays on its leaving the reflector. This is effected by closing the mouth of the reflector with glass furnished with movable glass plates. Consequently the effective invisible rays do not leave the reflector till its glass front is opened, and they produce in the receiver at the second station of terminus, the invention of Professor Zickler, longer or shorter electro rays corresponding to the dots and dashes of the Morse alphabet, their length depending on the length of time during which the mouth of the reflector was open. It is easy to transfer these signs reproduced by the rays to an electric bell, a Morse electric magnetic instrument, or a telephone. Professor Zickler showed his invention at the meeting, and, with the help of an electric arc lamp, he transferred signs to a writing apparatus and to a telephone at the other end of the room. He has extended his experiments to distances up to $1\frac{1}{2}$ kilometres, and he hopes soon by means he possesses for increasing the effectiveness to be able to use this kind of telegraphy for distances which will enable it to be employed for divers practical purposes.—Ex.

ELECTRO-PLATING.

NAVAL REPORT ON ELECTRO-PLATED HULLS.

The United States ocean-going tug "Assistant," whose hull was electroplated and launched in February, 1895, was recently docked at Norfolk and subjected to a critical examination. The report of the naval construction department states that the vessel's bottom was found to be absolutely free from barnacles or marine growth of any kind, and it is recommended that the process be applied to the war ships of the navy. It is suggested that not less than 1-16 inch of copper plating should be placed on the bottom of the vessel, and it is believed that no currosive effect due to electrolysis will result from such electro-plating. Briefly stated, the method of electro-plating the hulls of vessels is about as follows. A shallow, flexible box-shaped plating bath is supported against the side of the vessel and filled with the plating solution. The vessel is made the negative pole of the circuit, by connection with an electric generator, and a copper electrode in the plating solution furnishes the positive pole. A current of $7\frac{1}{2}$ amperes to the square foot, at a difference of potential of $1\frac{1}{2}$ volts, is employed, and about three days are required to deposit a plating of suitable thickness in one place. The electro-plating progresses by patches, small portions of the hull being cleaned in advance of the removal of the plating bath from point to point about the hull.—Ex.

ELECTRO TECHNICS.

ANNUNCIATOR CONNECTIONS.

In the following sketch, with annunciator marked A and switch marked S, are shown the connections by means of which signals may be sent to a central room or an electric police man is kept in the house for the purpose of detecting

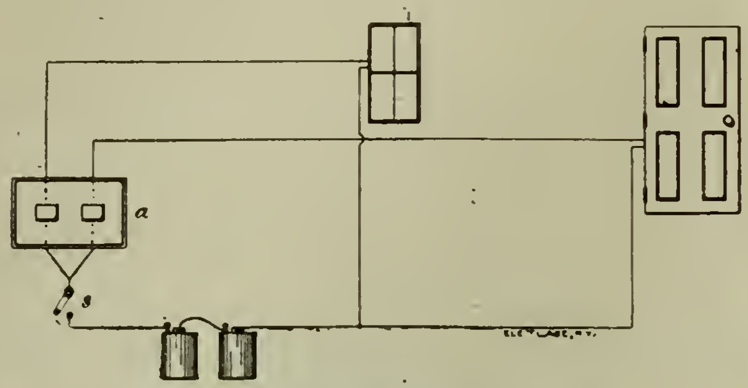
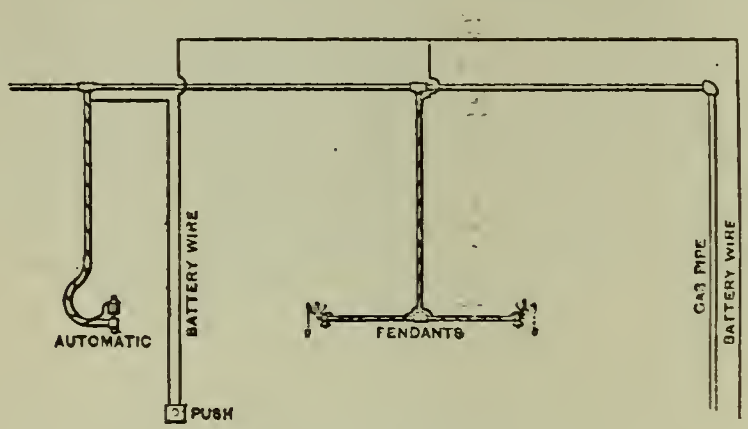


Diagram of Annunciator Connections.

open doors or windows. The system of connection is very simple, a common leg being used to which both door and windows are tapped and a separate return to each annunciator drop, as shown in sketch. This idea may be followed out to any extent with any number of annunciator drops.

AUTOMATIC GAS LIGHTS.

A grounded gas lighting system is shown in which one wire is connected or soldered to the gas pipe and the other wire runs in series from one gas tip to the other. The battery wire is shown leading upward and the pendant drop to which it is connected so that a discharge takes place between the battery wire and gas pipe when pendant is pulled. The push button controlling a single automatic burner appears on the left. The pendant is mechanically



Connections for Gas Lighting.

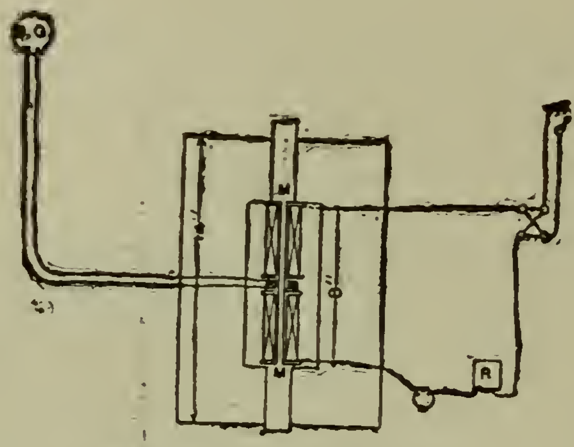
automatic in the sense that when pulled a flash occurs. Either system or both may be employed at the same time.

MEASURING LINES OF FORCE.

For measuring lines of force the following system of connections must be made. The outer coil MM is connected to a source of current. The inner coil connected to ballistic galvanometer BG. When current is switched into the outer coil MM the lines of force pass through the inner coil and produce a swing in the galvanometer from which the lines of force can be calculated. By making use of a long helix, that is to say this method, the area of induction multiplied by the magneto motive force gives the elements by means of which H can be calculated.

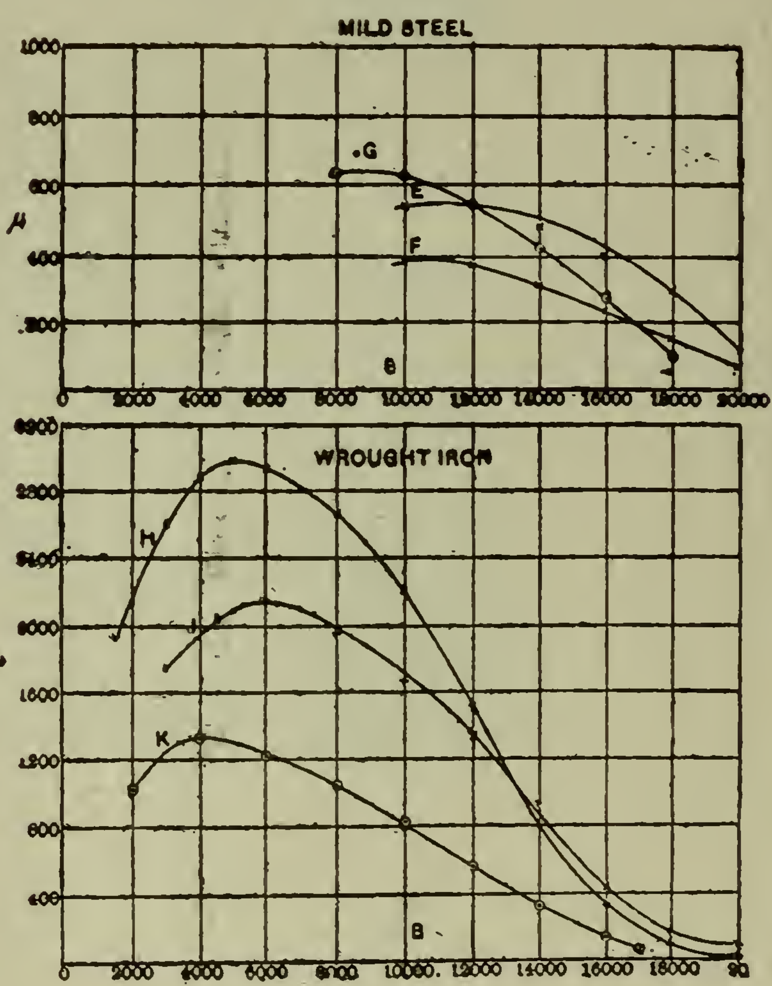
THE PERMEABILITY OF WROUGHT IRON AND STEEL.

The permeability of a magnetic metal is similar in many respects to the expression "conductivity." The differences between the permeability of various metals are not as great as the variations in conductivity, but display some interesting phenomena when exposed to the influence of a powerful magneto motive force. In the two diagrams are shown samples of wrought iron and mild steel, whose native permeability is high, which have been magnetized up to one hundred thousand lines of force per square inch and through all the various stages of magnetization the permeability curve has been traced.



Measuring Lines of Force

Wrought iron at thirty thousand lines of force per square inch has a permeability of three thousand. At one hundred thousand lines per square inch its permeability falls to four hundred. Mild steel at the same rating of magnetization only has a permeability of two hundred and fifty. Its maximum permeability is about six hundred; its minimum about fifty when heavily saturated.



Permeability Curves.

THE PROPORTIONING OF COMMUTATOR SEGMENTS.

In designing commutators it is necessary to calculate with reference to the number of commutator bars required. For instance, under the head of divisions we find the number four which, with reference to an angle of ninety degrees, gives us a chord of 1.4142. In a commutator consisting of five divisions the angle to which each would be cut would

be seventy-two degrees. In a commutator consisting of six segments each would possess an angle of sixty degrees and the angle chord corresponding would be equal to one, that is to say, to the radius of the circle.

corresponding to the segment is thirty degrees, the chord of that angle .5176 of the radius and so on throughout. The number of commutator divisions with corresponding angles and chords are given for from four to three hundred and

DIVISIONS OF COMMUTATORS.

Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord
			26	13 51	.2411	51	7 03	.1231	76	4 44	.0826	101	3 34	.0622
			27	13 20	.2322	52	6 55	.1208	77	4 41	.0815	102	3 32	.0615
			28	12 51	.2236	53	6 47	.1185	78	4 37	.0805	103	3 30	.0610
4	90	1.4142	29	12 25	.2162	54	6 40	.1163	79	4 33	.0795	104	3 28	.0604
5	72	1.1756	30	12	.2091	55	6 33	.1142	80	4 30	.0785	105	3 26	.0598
6	60	1.0000	31	11 34	.2022	56	6 26	.1122	81	4 27	.0775	106	3 24	.0592
7	51 26	.8678	32	11 15	.1960	57	6 19	.1102	82	4 23	.0766	107	3 22	.0587
8	45	.7654	33	10 55	.1902	58	6 12	.1083	83	4 20	.0756	108	3 20	.0582
9	40	.6840	34	10 35	.1844	59	6 06	.1064	84	4 17	.0748	109	3 18	.0577
10	36	.6180	35	10 17	.1792	60	6	.1047	85	4 14	.0739	110	3 16	.0572
11	32 44	.5636	36	10	.1743	61	5 54	.1029	86	4 11	.0730	111	3 15	.0567
12	30	.5176	37	9 44	.1694	62	5 48	.1012	87	4 08	.0722	112	3 13	.0561
13	27 42	.4788	38	9 28	.1653	63	5 43	0997	88	4 05	.0715	113	3 12	.0556
14	25 43	.4451	39	9 14	.1611	64	5 37	.0980	89	4 02	.0706	114	3 10	.9551
15	24	.4158	40	9	.1569	65	5 32	.0966	90	4	.0699	115	3 08	.0546
16	22 30	.3902	41	8 47	.1532	66	5 27	.0952	91	3 57	.0690	116	3 06	.0542
17	21 11	.3674	42	8 34	.1495	67	5 22	.0937	92	3 55	.0683	117	3 05	.0538
18	20	.3473	43	8 22	.1461	68	5 18	.0923	93	3 52	.0675	118	3 03	.0534
19	18 57	.3291	44	8 11	.1427	69	5 13	.0910	94	3 50	.0663	119	3 02	.0529
20	18	.3129	45	8	.1395	70	5 08	.0897	95	3 47	.0661	120	3	.0524
21	17 09	.2980	46	7 49	.1364	71	5 04	.0884	96	3 45	.0654	121	2 58	.0520
22	16 23	.2850	47	7 40	.1335	72	5	.0872	97	3 43	.0647	122	2 57	.0515
23	15 39	.2723	48	7 30	.1308	73	4 56	.0861	98	3 40	.0640	123	2 56	.0510
24	15	.2611	49	7 21	.1282	74	4 52	.0849	99	3 38	.0634	124	2 54	.0505
25	14 24	.2507	50	7 12	.1256	75	4 48	.0838	100	3 36	.0628	125	2 53	.0501

Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord
126	2 51	.0497	151	2 23	.0416	176		.0356	201	1 47	.0311	226		.0277
127	2 50	.0494	152	2 22	.0413	177	2 02	.0355	202		.0309	227	1 35	.0276
128	2 49	.0490	153	2 21	.0410	178		.0353	203	1 46	.0308	228		.0275
129	2 47	.0486	154	2 20	.0407	179	2 01	.0352	204		.0306	229		.0274
130	2 46	.0483	155	2 19	.0404	180	2	.0349	205	1 45	.0305	230	1 34	.0273
131	2 45	.0480	156	2 18	.0401	181	1 59	.0346	206		.0303	231		.0272
132	2 44	.0476	157	2 17	.0398	182	1 58	.0343	207	1 44	.0302	232	1 33	.0271
133	2 42	.0471	158	2 16	.0395	183		.0341	208		.0301	233		.0270
134	2 41	.0468	159	2 15	.0393	184	1 57	.0340	209	1 43	.0299	234	1 32	.0268
135	2 40	.0465	160	2 15	.0392	185		.0338	210		.0297	235		.0267
136	2 39	.0462	161	2 14	.0389	186	1 56	.0337	211	1 42	.0296	236		.0266
137	2 38	.0459	162	2 13	.0387	187	1 55	.0334	212		.0295	237	1 31	.0265
138	2 36	.0455	163	2 12	.0384	188		.0333	213	1 41	.0294	238		.0264
139	2 35	.0451	164	2 11	.0382	189	1 54	.0332	214		.0293	239		.0263
140	2 34	.0448	165	2 11	.0381	190		.0330	215		.0292	240	1 30	.0262
141	2 33	.0445	166	2 10	.0378	191	1 53	.0328	216	1 40	.0291	241		.0261
142	2 32	.0442	167	2 09	.0376	192		.0326	217		.0289	242	1 29	.0259
143	2 31	.0439	168	2 09	.0375	193	1 52	.0325	218	1 39	.0288	243		.0258
144	2 30	.0436	169	2 08	.0372	194	1 51	.0323	219		.0286	244		.0257
145	2 29	.0433	170	2 07	.0369	195		.0321	220	1 38	.0285	245	1 28	.0256
146	2 28	.0430	171	2 06	.0367	196	1 50	.0320	221		.0283	246		.0255
147	2 27	.0427	172	2 06	.0365	197		.0318	222	1 37	.0282	247		.0254
148	2 26	.0425	173	2 05	.0363	198	1 49	.0317	223		.0281	248	1 27	.0253
149	2 25	.0422	174	2 04	.0361	199		.0315	224		.0280	249		.0252
150	2 24	.0419	175	2 03	.0358	200	1 48	.0314	225	1 36	.0279	250		.0251

Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord	Div.	Angle ° ′	Chord
251	1 26	.0250	276		.0228	301		.0208	326		.0193	351		
252		.0249	277	1 18	.0227	302		.0207	327	1 06	.0192	352		.0178
253		.0248	278		.0226	303			328			353		
254	1 25	.0247	279		.0225	304	1 11	.0206	329		.0191	354	1 01	.0177
255		.0246	280	1 17	.0224	305		.0205	330		.0190	355		
256		.0245	281		.0223	306			331			356		
257	1 24	.0244	282		.0222	307		.0204	332	1 05	.0189	357		.0176
258		.0243	283		.0221	308	1 10	.0203	333			358		
259		.0242	284	1 16	.0221	309			334		.0188	359		
260	1 23	.0241	285		.0220	310		.0202	335			360	1	.0175
261		.0240	286		.0219	311		.0201	336		.0187	361		
262		.0239	287		.0218	312			337	1 04	.0186	362		.0173
263	1 22	.0238	288	1 15	.0218	313	1 09	.0200	338			363		
264		.0237	289		.0217	314			339		.0185	364		.0172
265		.0236	290		.0216	315		.0199	340			365		
266	1 21	.0235	291		.0216	316			341		.0184	366	0 59	.0171
267		.0234	292	1 14	.0215	317	1 08	.0198	342			367		
268		.0234	293		.0214	318			343	1 03	.0183	368		.0170
269		.0233	294		.0213	319		.0197	344			369		
270	1 20	.0233	295		.0213	320			345		.0182	370		.0169
271		.0232	296	1 13	.0212	321		.0196	346		.0181	371		
272		.0231	297		.0211	322	1 07	.0195	347			372	0 58	.0168
273	1 19	.0230	298		0210	323			348	1 02	.0180	373		
274		.0229	299		0210	324		.0194	349			374		
275		.0228	300	1 12	.0209	325			350		.0179	375		.0167

Table of Commutator Segments.

By using this table as thus outlined, the draughtsman will save considerable time and trouble in lying out commutators, the segments of which, with reference to the diameter and length of chords,a re fully given. In a commutator of twelve divisions, as a final illustration, the angle of the chord

seventy-five segments with angles running from ninety degrees to less than one degree.

Electricity and machinery have 48,000 square feet in the United States exhibit at the Paris Exposition of 1900,

LIGHTING.

THE NERNST LAMP.

With the Welsbach burner has come a new incandescent lamp which, though not the most efficient electrical illuminating device at present, still represents a distinct advance in electric lighting. Thoria, which is the element employed by Dr. Nernst in the construction of his lamp will, if a large demand is made for it, become one of those many commodoties whose original cost was high but which, through invention and demand, fell to a nominal figure.

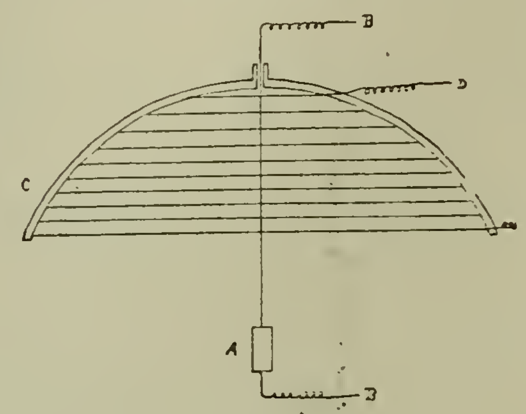
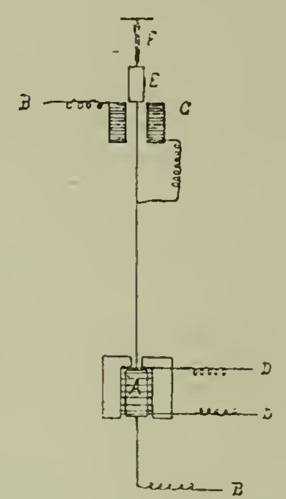


FIG. 1.



Nernst Lamp, Automatic Shunt, Etc.

A mineral of this kind possesses originally a high resistance but after being heated the reduction in resistance is so noticeable that upon passing a current through it a magnificent incandescence occurs. Although white hot in the open air no perceptible diminuation in volume occurs, simply because oxydation is almost impossible. In Dr. Nernst's lamp the current is automatically switched from a small platinum spiral, which first heats the light giving element, through the element itself after the proper rise of temperature has been observed. This unsatisfactory feature of construction may be removed in the course of time but at present its only recommendation consists of deep interest on the part of electricians.

OBITUARY..

FRANK H. BADGER, JR.

Frank H. Badger, Jr., formerly manager of the Montmorency Electric Power Company, of Quebec, died of pleuro pneumonia March 6th, at the residence of his father, Montreal. Mr. Badger was a thorough electrical engineer, being a specialist on high potential work. He leaves a widow.

AMONG THE SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

By courtesy of the American Society of Civil Engineers, the 196th meeting of the Society will be held at its house, 220 West 57th Street, on Wednesday, March 29th, at 8 P.M. Professor Elihu Thomson will lecture on Electricity at High Pressures.

Prof. Thomson, the distinction of whose work in this field has long been generally recognized, will describe various methods or means for obtaining high potentials, and show the limits thus far reached. In connection with this, the construction of high frequency apparatus will be explained, and for the first time will be shown a novel machine for high potentials, which has just been devised by Prof. Thomson. A further branch of the subject to be treated covers the actions occurring at high pressures, and insulation at high pressures. The useful applications of high pressure currents will also be discussed, together with their conditions and limitations. The lecture will be accompanied by illustrative experiments.

Great interest in the coming meeting has been manifested throughout the electrical circles of New York and vicinity, and it is certain that this rare opportunity of hearing Prof. Thomson will be highly appreciated. In order to further its success the following arrangements have been made:

Special admission tickets will be issued to members desiring to be present, who announce their intention to the secretary by mail not later than the morning of Saturday, March 25th, when the ticket list will be closed. Although it is doubtful whether the accommodation of the hall, which is limited to 400 seats, will permit of ladies being invited, arangements to that end will be made if possible. Members asking for tickets will therefore state if they wish to bring a lady, and the admission ticket will be issued to "Member only," or "Member and lady," according to the seating space available when the acceptance list has been made up on the 25th inst. After allotment to members has been made on that day, the tickets remaining, if any, will be sent to New York sister societies, from many of whose members requests for admission to the lecture have been received.

BUSINESS NEWS

"NAVY" STANDARD DRY BATTERIES.

The New Standard dry batteries, made by William Roche, 259 Greenwich St., New York City, without doubt surpass every other make of dry batteries in the United States on account of their high voltage, low internal resistance and high amperage. Early in 1898 Mr. Roche was called upon by the Navy Department of the United States to furnish some special dry batteries under the very requirements of 1.40 volts and 3 ohms internal resistance. Mr. Roche supplied the Navy Department with batteries which, upon test, gave a voltage of 1.47 volts with an internal resistance of .15 ohms. The department then raised the standard of requirements to 1.47 volts and .3 ohms internal resistance. Mr. Roche experimented further and is now furnishing the Navy Department with dry batteries that exceed anything ever attempted in dry battery departure. The latest test shows 1.59 volts and not over .12 ohms internal resistance.

Mr. Roche's new Standard dry batteries are in great demand all over the United States. From a small beginning in part of a loft he now occupies two large floors for the manfacture of these popular batteries, and at present is engaged in securing an entire building in order to meet his orders promptly.

Mr. Roche makes the small pocket dry batteries necessary for the lighting of miniature lamps, buttonhole novelties of all descriptions, scarf pins and other experimental purposes. He makes any style and shape of battery required. It is very interesting to hear Mr. Roche relate some of his experiences in supplying batteries. For instance, he furnished a customer with several small cells of special make and an induction coil, all of which would lay in the palm of one's hand. He was subsequently informed that this tiny outfit won many thousands of dollars for the owner of a worn out stallion at one of the noted race courses nearby. Mr. Roche cannot demand from his customers.

Mr. Roche must know the amount of work his cells are to do and the space they are to occupy. Large dealers in

dry batteries are not advised to wait until their supply is exhausted before ordering a new stock. By making preparations in advance the rush is avoided which at present is forcing Mr. Roche and a large staff of assistants to work day and night to catch up with orders. Mr. Roche will be settled in his new factory about May 1st and will then be prepared to supply quadruple his present output.

A NEW ERA IN ENGINE INDICATORS.

A few years ago engine indicators were sold in limited quantities and generally to experts, the average engineer not feeling able to buy one. A change took place about seven years ago, and now almost every engineer of any sizable plant feels that his education and outfit is incomplete if he don't own an indicator and know how to use it. Improvements have been made over the old style, very much clearer instructions for applying and operating furnished, and the price is just one-half for a much better instrument than what was considered the best. This change was brought about by Jas. L. Robertson & Sons, Fulton street, N. Y., whose model factory continues to turn out more indicators than most of the others combined, with every one of which they are willing to give the strongest guarantee of excellence in workmanship, efficiency, handsome appearance and durability. This new era marked the introduction of a reducing wheel, the Improved Victor, which is made to attach to any indicator, and with such wide range that it will take in any stroke or speed by merely changing a bushing. The Lippincott planimeter is also in line with this new departure and is well worth the attention of those owning indicators. All of these instruments are fully illustrated and priced in their printed matter, which is to be had for the asking.

SPECIAL EXPORT COLUMN.

ELECTRICAL EXPORTS FOR WEEK ENDING MARCH 1, 1899, $26,513.00.

The following are the exports of electrical material from the port of New York for the week ending March 7th:

Alexandria—38 cases, $9,893.
Antwerp—41 cases, $3,357.
Australia—11 packages, $3,000.
Berlin—10 packages, $340.
Brazil—69 packages, $3,210.
Bremen—2 cases, $174.
British Possessions in Africa—5 packages, $194.
British West Indies—43 packages, $460.
Central America—21 cases, $466.
Chili—7 cases, $53.
Christiana—65 packages, $1,272.
Ecuador—1 case, $26.
Hull—4 packages, $50.
Liverpool—21 packages, $1,105.
Mexico—83 packages, $2,066.
Porto Rico—2 cases, $18.
Southampton—8 cases, $155.
U. S. Colombia—5 cases, $141.
Venezuela—69 cases, $533.

NEW INCORPORATIONS.

Greenburgh, N. Y.—Ardsley Electric Co. has been incorporated by Newton Clark Lyon, Samuel T. Davis, Jr., Lewis A. Beebe; electricity for light, heat and power. Capital stock, $50,000.

Riceville, Iowa.—Riceville Electric Light and Power Co. has been incorporated by C. C. Earnest, B. N. Hendricks, E. C. Richmond, R. Templeton, and M. Thielen; constructing and maintaining electric light and power plants. Capital stock, $10,000.

Augusta, Ga.—The Augusta Heat, Light & Power Co., incorporated by H. C. Perkins and others. Capital stock, $100,000.

Pueblo, Colo.—Pueblo Traction and Electric Co. has been incorporated with a capital stock of $500,000. A consolidation of Pueblo Light and Power Co. and Pueblo Electric Street Railway Co., for the purpose of floating improvement bonds.

Glencoe, Minn.—Glencoe Electric Light Co. has been incorporated by W. C. Russell, B. F. Allen, E. E. McIntire, G. K. Gilbert, Frank Kasper, and J. A. Wadsworth; electric light, power and heat. Capital stock, $8,000.

Camden, N. J.—The Eastern Consolidated Electric Light Company has been incorporated, with a capital stock of $1,500,000.

Knoxville, Tenn.—Capitalists of Knoxville and Salisbury, N. C., have formed a strong company to furnish electric power to Salisbury, Greenville and other Western North Carolina towns.

New York, N. Y.—American Oddity Co. has been incorporated by F. W. Longfellow, B. A. Gould, and J. H. Mason; to manufacture electrical novelties. Capital stock, $5,000.

Fayetteville, N. Y.—Fayetteville Electric Light Co., incorporated by Charles T. Collins, Amos Gillette, and Sarah L. Collins; make and sell electric light. Capital stock, $12,-0000.

Hackensack, N. J.—Bergen and Passaic Light, Heat and Power Co., incorporated by Cyrus O. Baker, Jr., William A. Linn, George A. Guy, and Herbert B. Coho; manufacture electricity. Capital stock, $100,000.

New York, N. Y.—Empire Gas and Electric Fitting Co. has been incorporated by Albert H. Petereit, W. E. Dwight, and William S. Nicholls. Capital stock, $10,000.

Belding, Mich.—The Citizens' Light Co. has been incorporated by Maurice A. Reed, John Greenup and Frank R. Chase; to furnish electric power and light in the counties of Kent, Ionia and Montcalm. Capital stock, $25,000.

Trenton, N. J.—The United Electric Co. has been incorporated, with a capital stock of $20,000,000; for the purpose of acquiring and consolidating the electric light companies of Essex, Hudson and adjoining counties in Northern New Jersey.

TELEPHONE CALLS.

Springfield, Ill.—The National Automatic Telephone Co., of West Virginia, with a capital stock of $150,000, has been licensed to do business in this State, with $2,500 capital.

Woonsocket, S. D.—Dakota Southern Telephone Co. has been incorporated by Charles M. Hopkins, Gib Dziewanowski, and Robert S. Vasey. Capital stock, $50,000.

Baltimore, Md.—The Home Telephone Co. is now controlled by the United Railway and Electric Company.

Port Clinton, Ohio.—Port Clinton Telephone Co. has been incorporated by Ed. L. Barber, James S. Brailey, W. H. Wilson, E. A. Powers, W. H. Althoff; telephone exchange. Capital stock, $15,000.

Hopkinsville, Ky.—The Cumberland Telephone & Telegraph Co., increased capital stock from $3,000,000 to $6,-000,000.

Orangeburg, S. C.—The Orangeburg Telephone Co., incorporated by W. Hampton Dukes, W. C. Wolfe, and A. C. Andrews. Capital stock, $1,000.

Lake Park, Minn.—Lake Park and Ulm Telephone Co., incorporated by R. T. Gilmore, John Nilson, C. E. Bjorge, A. Youngberg, T. C. Hawley, Casper Martinson and others. Capital stock, $5,000.

Boonville, Mo.—Boonville Telephone Co., incorporated by J. F. Gmelich, C. A. Sombart, E. W. Chilton and others; telephone exchange. Capital stock, $8,000.

Sauk Centre, Minn—Sauk Centre Telephone Co., incorporated by F. W. Sprague, W. A. Barto, W. O. P. Hilsdale and others; telephone system. Capital stock, $10,000.

Pulaski, Va.—The Radford Telephone Co., incorporated by D. D. Hull, B. Laughon, George M. Holstein and B. F. Garnett. Capital stock, $5,000.

POSSIBLE INSTALLATIONS.

Houma, La.—The Houma Light and Ice Manfacturing Co. will establish an eletric light plant.

Madisonville, Ky.—The Buckeye Spoke Co. is installing

a complete incandescent electric light plant.

Williamsport, Md.—The Mayor may be addressed concerning proposed erection of electric light plant.

Newport News, Va.—The Peninsular Electric Light and Power Co. is making important improvements to its plant.

Louisburg, N. C.—An electric light plant will be established.

Power Co. has been awarded contract for lightning Sea Isle City.

BUSINESS CHANGES.

Ottawa, Ohio.—The Electric Light Co. has increased its cauital from $30,000 to $40,000.

FLASHES.

Boston, Mass.—The Commercial Electrical Company damaged by fire.

JOTTINGS.

W. N. HOBART, president of the Triumph Electric Company, Cincinnati, Ohio, was in town this week. Mr. Hobart states that they are doing a large business with their dynamo, giving twenty lights per horse power.

WILLIAM N. FAMOUS, manager of the New York branch of the Lynon Incandescent Lamp Company, office, 136 Liberty street, is making a record for himself and is living up to his name. Mr. Famous is an electric incandescent lamp expert and as such is known all over the country.

JOHN E. FULLER has lately opened an office and factory at 93-95 Maiden Lane, where he has a shop fully equipped for manufacturing and repairing all kinds of electric apparatus and fine machinery. Mr. Fuller has a large stock of 110-volt motors with 6 to 12 inch fans. These motors are well made and of good design, a large number of them now being in use. He is selling these motors at a sacrifice as he is preparing to manufacture a full line of fine battery motors exclusively. Mr. Fuller has had a long and varied experience in the electrical field, being also at one time electrician of the old United States Electric Company, and with a competent staff of electrical workers is prepared to go ahead with all kinds of electrical installations.

EDWIN O. WAYMIRE, secretary and treasurer of the Dayton Fan & Motor Company, of Dayton, Ohio, was in town this week looking over the field preparatory to the spring campaign.

THE MONTAUK MULTIPHASE CABLE COMPANY, 100 Broadway, have issued an artistically gotten up brochure entitled, "For Your Good and (Incidentally) Our Own," containing a complete description of their multiphase cable. Copies will be sent on application.

We would call particular attention to the old reliable house of J. H. Bunnell & Co., whose advertisement appears on another page. Our readers may rest assured that all orders placed with the above firm will receive the same careful and intelligent attention as heretofore.

Mr. Chas. McLaughlin, the surviving member of the firm, who has been the active manager of the concern from its inception, is still at the helm with thoroughly competent assistants in the various departments.

The numerous friends of the house are assured that rumors circulated by interested parties as to any changes in the management, or of any interest in it being for sale, are entirely unfounded.

The Electrical Age.

VOL. XXIII—No. 12 NEW YORK, MARCH 25, 1899 WHOLE No. 619

THE TELEGRAPH.

Marconi.

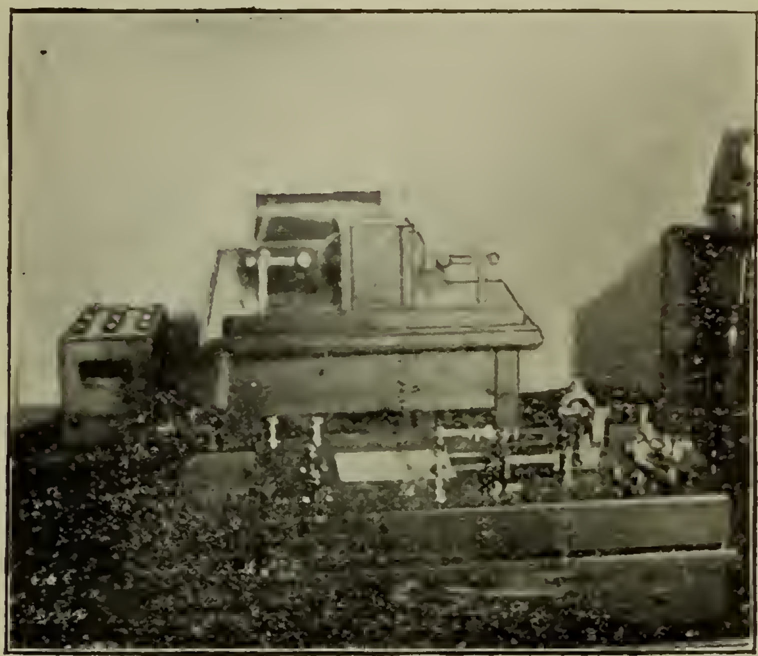
THE LATEST METHODS IN TELEGRAPHY.

Since the original invention of the telegraph by Morse it has developed along the original lines to a state of perfection that is simply marvelous. A simple telegraphic system presents little that the imagination cannot easily grasp. Duplex, quadruplex and multiplex systems, representing the work of Sterns, Edison and Delaney, at present belong to a past regime. The telegraph has so far improved that there is an immediate possibility of a transformation occuring which will influence not only the telegraph lines of the United States but those of Europe, Asia and Africa. It is but natural for a simple principle, when properly developed, to become more or less complex. In the course of time a further extension of the principle is apt to transform it again to its original simplicity.

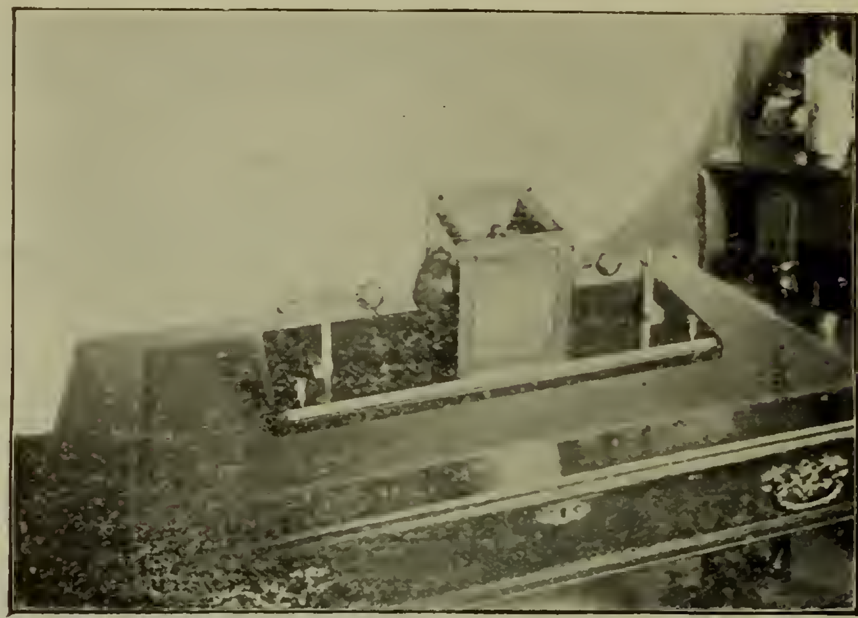
The Delaney system by means of which one hundred messages can be sent over the line at the same time, as illustrated, is practically a Morse system with a dial plate containing an arm which, when rotating, is in perfect synchronism with that of a similar and distant dial plate. The invention of Marconi enables us so dispense entirely with the wire and make use of Hertzian waves which may be thrown into space a distance of thirty miles, at the present writing, and intelligibly recorded.

Messrs. Squier and Crehore, connected with the United States army, have conducted a series of practical experiments with alternating currents; the rise and fall of a sine wave being utilized in such a manner that five thousand signals a minute can be transmitted. This instrument is called the synchronograph and

in it is represented all that the human race can aspire to in the perfection and application of the electric current over a line. The Marconi system is imperfect in the respect that the distance of transmtssion is limited and the coherer is apt to become de-

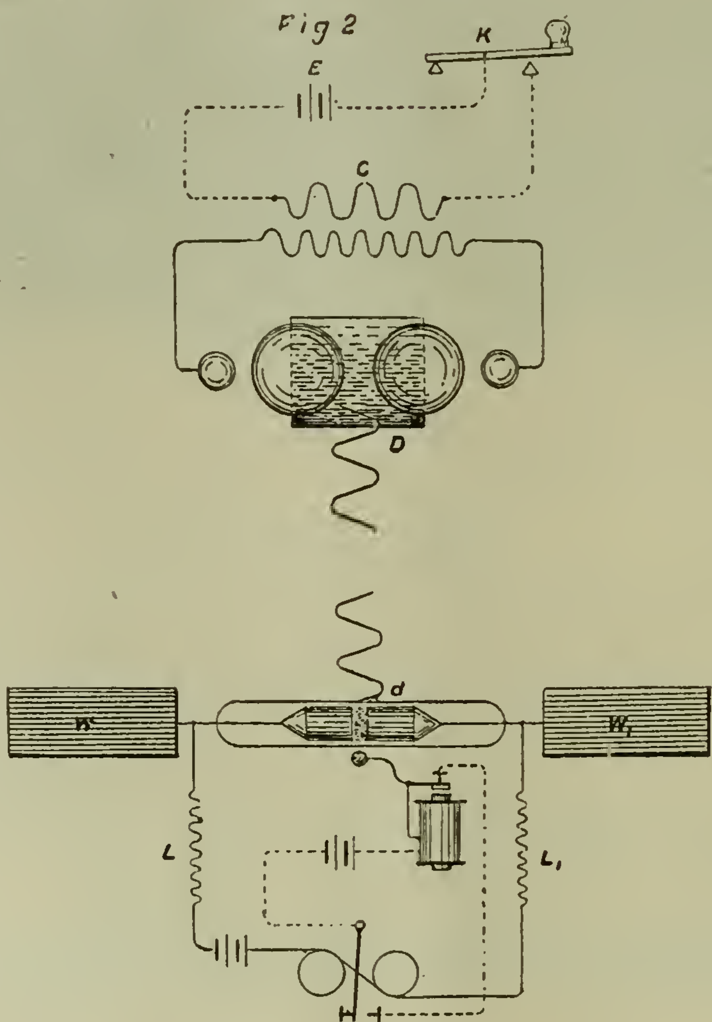


Wireless Telegraphy Outfit.



Coherer.

fective. If it were possible to project Hertzian waves a greater distance through the etheral atmosphere and so adjust the receiving and sending instruments that they will only respond to



Theory of Wireless Telegraphy.

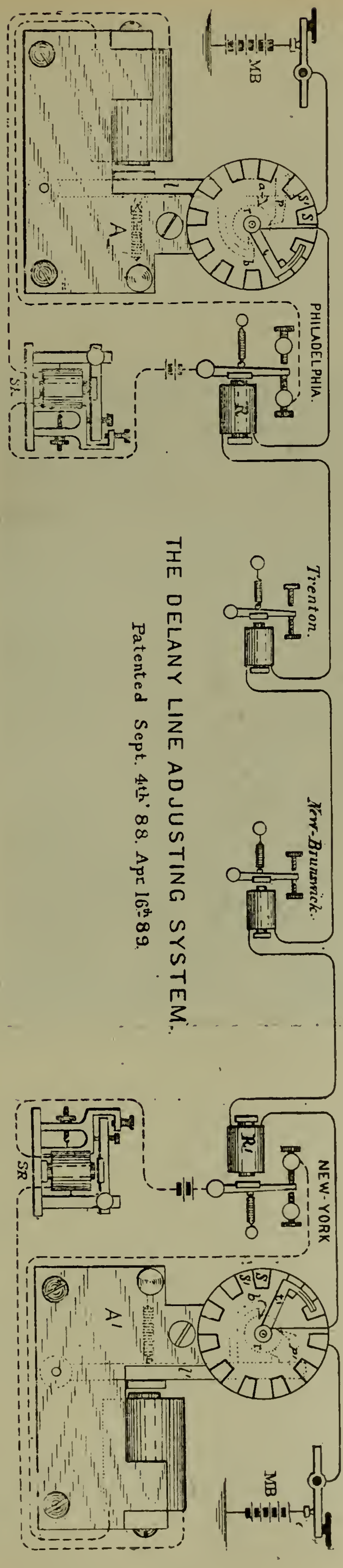
each other then the possibility of any other device coming into general use is entirely improbable.

Before a decade is passed the certainty of using a new telegraphic system is more pronounced than ever before. Scientific applications have assumed such a character that the discovery of any new principles implies at once a new department of industrial activity. The advantages however of a telegraphic system, speedy, certain and thoroughly reliable are so obvious that it may be said that capital is waiting for invention and not the reverse, as is generally the case.

"Why is a merchant who does not advertise like a man in a rowboat?" asked the student of a companion.

"Keeps going backward," guessed his friend.

"No; he is trying to get along without sales."—Ex.



The Delaney System.

AUTO-MOBILES.

AUTOMOBILE AND HORSE.

The increasing use of the horseless carriage in the large cities of this country is all the argument needed to prove its timely arrival. Buffalo is a little more conservative than some other American cities in adopting new ideas and the automobile carriage, though not unknown here, can hardly be regarded as an established feature of Buffalo life.

In some Eastern cities the horseless carriage, as a pleasure vehicle, has been supplemented, more or less experimentally, by auto-trucks for heavy traffic, omnibus lines and other utilitarian purposes. In New York a line of electric or gasoline-motor carriages will soon be in operation on Fifth avenue. The desire appears to be to eliminate the horse from down-town use in the busy streets of the metropolis, largely to reduce the danger of accident. The automobile is (or is supposed to be) always under the control of the driver. It does not require strong arms to hold it. It will not run away, and it won't break away if left alone for a moment. It won't shy, neither will it balk. It backs well. It is an improvement on the street car for the reason that it will meet the passenger at the curb, and is available on streets where are no car tracks. The motor carriage is conducive to clean streets. It does not litter them, and its pneumatic-rubber tires are an incentive to improved pavements.

Discussing the subject any way you please and the argument appears to be largely in favor of the modern vehicle for city transportation, at any rate, and for the relegation of patient old "Dobbin" to the farm, and the high-priced horse to the hunt club, the military and the race track. Of course, it will take a long time to bring this about, but the use of the horse is bound to be affected by the general introduction of the automobile.

Hitherto, the small number of automobiles manufactured and the prices at which they are held, have interfered with their general use, but the experimental stage is apparently passed and another year will see thousands of motor carriages in the market.—Ex.

The following order has been sent by the Secretary of War to the commanding officers in Cuba, Porto Rico and the Philippines: "Until otherwise ordered, no grant or concessions of public or corporate rights or franchises for the Philippines. Until otherwise ordered, construction of public or quasi-public works, such as railroads, tramways, telegraph and telephone lines, waterworks, gasworks, electric light lines, etc., shall be made by any municipal or other local governmental authority or body in Cuba, Porto Rico or the Philippines, except upon approval of the Major-General commanding the military forces of the United States in Cuba, Porto Rico or the Philippines, who shall, before approving any such grant or concession, be specially authorized by the Secretary of War."

The first regular line of motor omnibuses began to run this week between Kew and Hounslow. The 'buses hold 12 in and 12 out. The promoters are satisfied with results, and we may expects to see motor 'buses put on other routes.

"The art making one's fortune is to spend nothing. In this country any intelligent young man may become rich if he stops 262 electric railway motors and eight generators for English railways.

The Westinghouse Co., it is said, has contracts on hand for all leaks and is not in a hurry. Do not make haste; be patient."

It is estimated that the exports of American electrical machinery for 1898 will exceed $2,000,000.

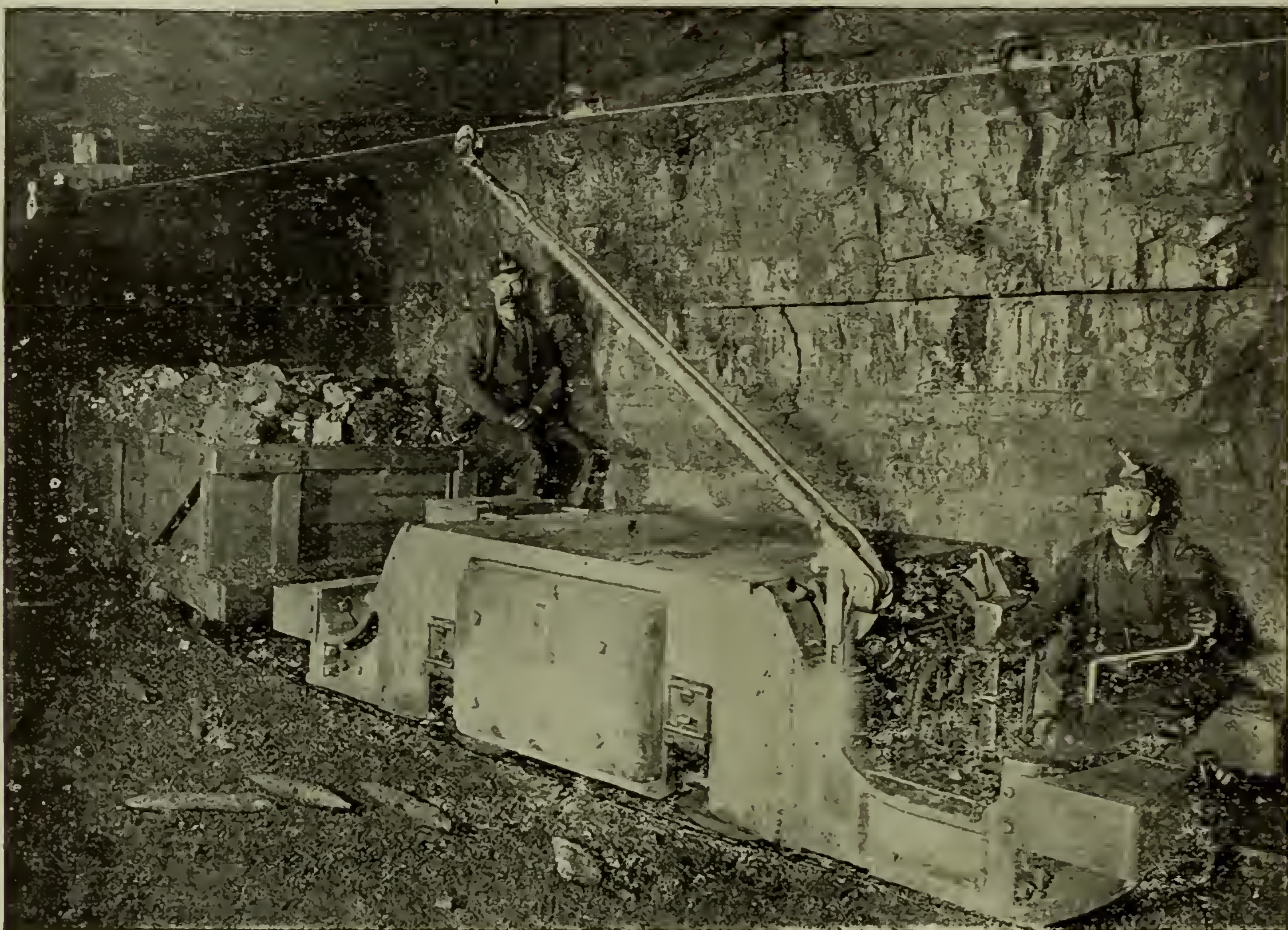
ELECTRIC LIGHT AND POWER.

ELECTRIC MINING LOCOMOTIVE.

The introduction of electricity into mines in the far West and the East has been the cause of saving annually many thousands of dollars and quite some few lives. The Jeffries Manufacturing Company, who make a specialty of such machines for practical mining, have introduced the above locomotive with considerable success in many of the largest mines of the United States. In mines where an electric plant is operating the convenience and direct advantages in a financial sense are so obvious that discussion is hardly necessary.

The fact that steam locomotives send into the mine noxious fumes and an immense amount of vapor shows conclusively that in many cases the use of mule or wire rope hoists, cable systems, etc., is an absolute necessity. Recourse to manual labor can always be made but the profits, which largely depend upon the enterprise of the proprietors and managers, are directly increased by the employment of labor saving devices, among the best of which may be considered the electric locomotive.

Where burrowing into the mountain side is the cause of difficulty in transporting ore an electric locomotive is a certain means of obviating the majority of troubles dependent upon the practice which involves labor of the severest order, an investment that leaves nothing at the end of the year to call one's own and a loss of time in delivering the crude ore.



Jeffries Mining Locomotive.

ELECTRIC POWER FOR STEEL WORKS.

Since the advent of three and five-motor electric cranes, many other machines, even more flexible in their fields of operation, have been designed and built, largely for use in rolling mills. Such, for example, are the various types of charging and drawing machines for placing ingots, slabs, and blooms in heating pits or furnaces, and for withdrawing them when heated; also machines for charging stock into melting furnaces, and for many other purposes, more or less special.

The greater part of the development in this field, however, has occurred in the last two, or possibly three years. In one of the largest steel plants, where between 7,000 and 8,000 horse-power of motors are in use, over one-half of that amount has been installed within the last eighteen months, and installation is still at the same rate.

Among incidental uses of electricity in rolling mills may be mentioned one which is deserving of far wider application than it receives,—the use of electro-lifting magnets for the handling of plates, bars, and ingots. A plate is a most awkward piece of material to take from the top of a pile by the ordinary methods. It generally has to be pried up with a bar far enough to allow hooks, suspended from the crane blocks, to be placed under it, and when it has been placed in the required position the hooks must be removed. These operations require at least two men, and, if time be an object, four. How much simpler, quicker, and cheaper it is to lower a magnet down upon the centre of the plate, close the switch to excite the magnet coils, transfer the plate to its required position and open the magnet circuit to release the plate!

The objection is often raised that it is dangerous to handle plates in this way, because the current may fail and allow a plate to drop on some one. In answer to this it may be said that a number of magnets have been in use in several large establishments for several years, and the first accident from this cause has yet to be reported. The saving in labor and time when a plate-handling crane is equipped with an electro-magnet is almost beyond credence.—Eugene B. Clark, in Cassier's Magazine for April.

The Electrical Age.

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CONTENTS:

COMMERCIAL INSULATION.

The use of porcelain and glass insulators for high voltage power transmission has been pretty well discussed by technical journals since the appearance of Mr. Scott's article on the subject of "High Potential Transmission."

From a purely practical standpoint it seems as if the construction of an insulator were of just as much consequence as its design. Various influences are at work in the case of china insulators operating collectively to break down the high insulating power of these devices. It seems as though heat, cold, dampness, alkalis and acids co-operatively or singly at some time or other are at work playing havoc with either the interior or exterior of insulators.

In order to obviate as far as possible these difficulties and effectively remedy them it is necessary to mix together before moulding a composite mass in which neither lead nor metallic oxide lurks. The failure of china insulators may frequently be traced to the final surface coating they receive in the form of glaze. Either this glaze is partly composed or mixed with a metallic oxide through which it becomes, in many respects, a conductor of electricity, or under the influence of heat, cold, etc., producing expansion and contraction, the glaze cracks, moisture gets inside and the insulator in its way becomes relatively a fairly good conductor upon which little or no reliance can be placed.

The consequence of shocks or blows is very noticeable in the insulating power of these devices, the chipping and cracking may be considerably increased and serious results follow of a nature above outlined. Another difficulty experienced by the manufacturers of insulators for which they cannot always be held responsible and yet which comes within the field of their experience is that of chipping, due to the effect of very high potentials. Remarkable as it may seem high electro motive forces alternating at a fair frequency exercise a distinct physical effect upon the surface and possibly the body of an insulator. In fact, it seems as though a large percentage of the rate of deterioration, beginning with what may be considered a new and good insulator, will result in one which outwardly preserves its shape and appearance but which has been completely changed, becoming entirely unserviceable for high potential insulating purposes.

Various styles of insulators have appeared on the market and are now being bought and sold consisting of two and three shells or petticoats, as they are vulgarly termed. They are exposed to tests with pressures that rise up to eighty thousand volts and which stand normally a potential of thirty thousand volts. The Cataract Construction Company, whose lines run between Niagara Falls and Buffalo, make use of a three part china insulator so shaped that the water, when dripping off, will not fall on the cross arms supporting it. It consists of three parts carefully fused together and when carrying a pressure of forty thousand volts seem to experience little or no leakage.

A review of this subject clearly indicates that the details of construction as well as the conditions which practice has brought into existence must be carefully studied as far as insulators are concerned. In earlier days it was hardly necessary to do any more than to construct a china or glass support for a telephone, telegraph or electric light wire. To-day the system has entirely changed. Wires are carried in conduits and encased with lead covering. Few if any insulators are used within the city limits for power or electric wires. The use of insulators has been regulated to the distinct suburbs of cities and may be found along main roads carrying pressures of extraordinary value without any perceptible injury to themselves or their supports.

During continued dampness or storm high pressure lines are naturally apt to suffer and unless the utmost care is taken to select insulators of great superficial area with uncracked glaze and of reputable make it is hard to anticipate continued success in any special problem of electric lighting or power transmission.

THE COST OF ELECTRIC LIGHT.

An article published in the "Scientific American," under the same heading, written by Mr. Adams, reviews the cost of electric light, calling the price for a sixteen candle power gas burner five mills an hour and for incandescent lighting about one cent per hour. The relative costs, according to this estimate, are about as two to one in favor of the gas jet.

Our opinion on the subject is largely to the effect that the cost of gas lighting is much greater than that of incandescent lighting. Fire risks are certainly decreased by the introduction of incandescent lamps. The dangers from asphyxiation disappear and the unpleasant heat so noticeable in summer is not present.

Aside from the subject it would be wise for the public to realize that oil is cheaper than gas and that a blazing wooden torch supported somewhere on the wall or a tallow candle might be cheaper than oil. As the world advances the nominal cost of a thing really dimishes and the conveniences and advantages derived from the use of some great invention are so obvious that the question of cost is rarely, if ever, discussed.

TECHNICAL NOTES.

DIRECT CONNECTED RAILWAY GENERATORS.

In the following table may be found considerable data relating to direct connected railway generators; the revolutions per minute, weight, number of poles, etc., being given. The table is interesting in showing the relation between weight and capacity in various sizes.

TABLE.

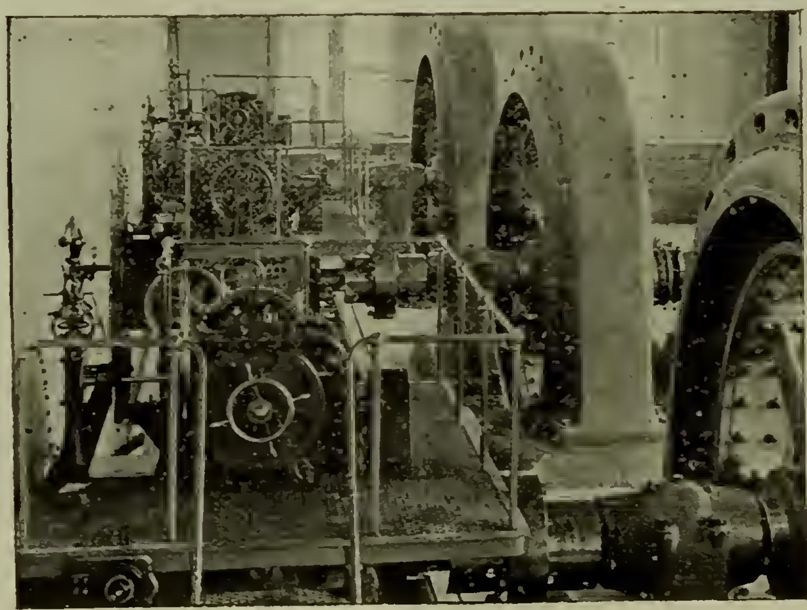
DIRECT-CONNECTED RAILWAY GENERATORS.

Poles.	No in Diagram.	Rated kilowatt output	C	R. P. M.	M	M. C kilod	Weight 1,000 lbs
10A.	1	500	910	125	264	240	64.0
10B.	2	..	....	75	440	364	87.1
10B.	3	..	.	90	367	334	76.0
10B.	4	...	...	100	330	300	71.3
10B.	0	800	1,450	80	412	600	110.0
10B.	5	...	...	120	275	400	94.4
10C.	6	...	....	100	330	480	100.9
8A.	7	400	725	80	412	300	71.2
8A.	8	...	....	120	275	200	64.3
8A.	9	...	....	100	330	240	71.4
6A.	10	150	270	200	165	44.5	13.1
6A.	11	225	410	200	165	67.5	25.1
6A.	12	..	...	150	220	90.0	34.3
6A.	13	...	...	120	275	113	37.0
6A.	14	300	545	200	165	90.0	39.1
6A.	15	...	...	150	220	[illegible]	43.9
6A.	16	...	....	100	330	[illegible]	60.4
6B.	17	400	725	150	220	100	59.7

Table of Street Railway Generators.

HORSE POWER PER SQUARE FOOT.

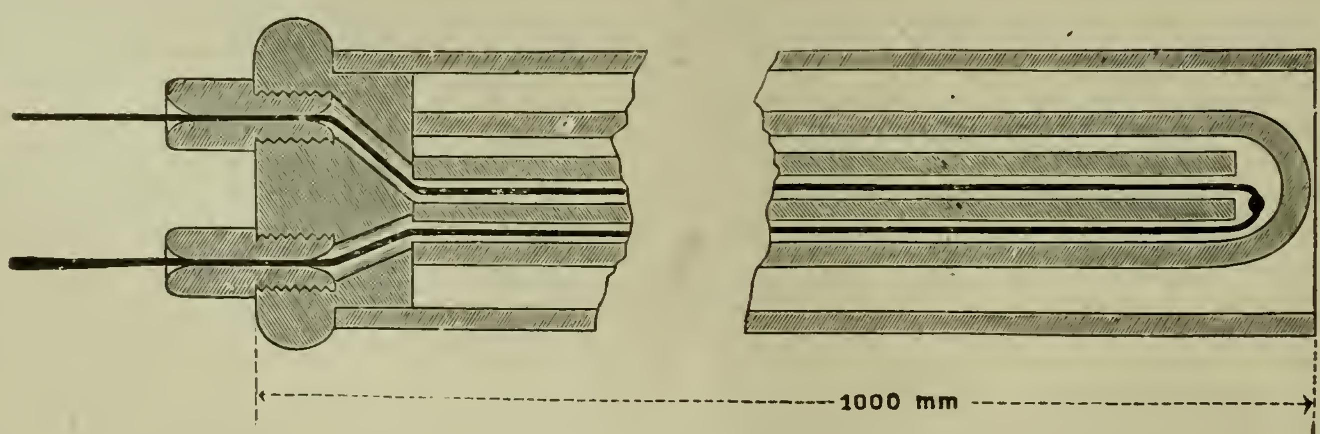
The rating of horse power per square foot where space is limited is a matter of interest to engineers. The Edison illuminating station, at Pearl and Elm Sts., having a capacity of two hundred thousand lights has a floor space of fifty by two hundred feet, that is to say, ten thousand square feet. The horse power generated is about twenty thousand. Consequently the horse power per square foot is equal to two. In private plants the space is much greater in proportion to the power because horizontal engines are employed instead of vertical. As an illustration of how space is utilized in a large electric light plant we show an illustration of a corner of one of the best known in this locality.



Corner of Modern Plant.

ELECTRIC BOMBS.

Possibly no implement of war is simpler in construction than a bomb exploded by electricity. It generally consists of an outer casing of steel or iron within which is a protected fusible wire. Between the wire and the outer wall the explosive material, gun cotton, dynamite or giant powder is packed. Upon sending the current the explosive compound is ignited and the report immediately follows. If a large, strongly made balloon were sup-



Electric Bomb.

TO RENT; POSSESSION AT ONCE.

...AMPLE POWER...

FOUR UPPER FLOORS,

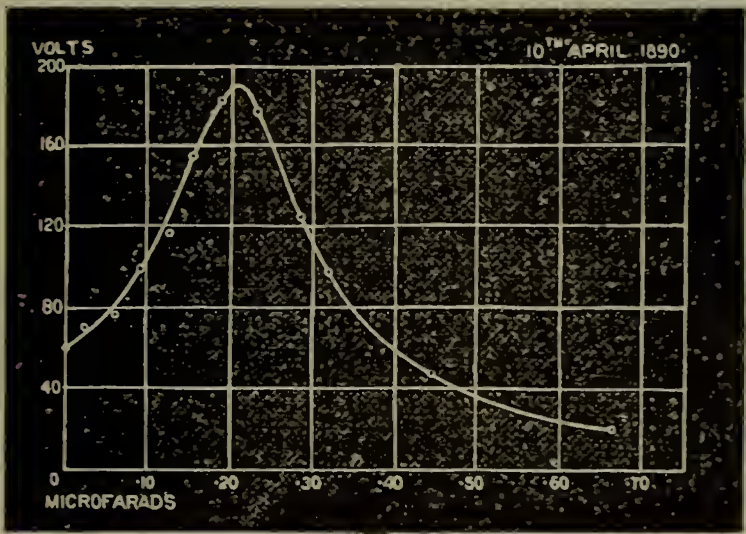
66 and 68 Duane Street.
New York

Apply at Estate of Thomas Vernon, 22-26 Reade Street, New York City....

ported in mid-air with a series of explosive bombs hanging from it, such a balloon, if dirigible, would be able to annihilate a small army by merely letting such appendages rest in the midst of the camp and pressing the button up above.

CONDENSER DISCHARGES.

The mere measurement of capacity enables the discovery to be made that uncertain elements are attached to the apparatus employed. Variable quantities influence the accuracy of result and internal changes take place in the condenser receiving consideration. The sketches shown have been plotted from results obtained with the use of enormous electro-motive forces and a comparatively small condenser. The pressure and capacity have been used as ordinates and abcissae.



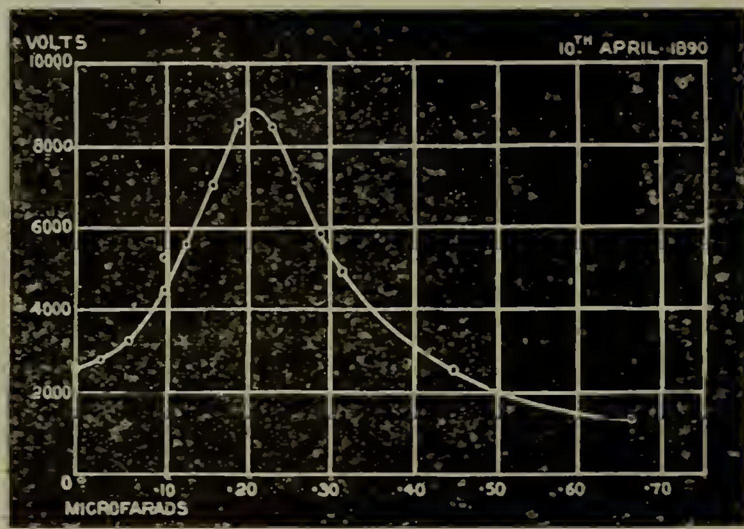
(I) Curves of Condenser Tests.

The maximum pressure applied in the other case reached one hundred and ninety volts. The capacity of the condenser was limited in both cases to seven tenths of a micro farad. The second portion of the curve is very similar to the discharge obtained by plotting after connecting condenser with a very high resistance. With a lower resistance a plotting of the almost instantaneous changes occurring in the condensers will show an undulating and tapering line.

The manifestation of dielectric hysteresis between the alternate plates when separated by paraffined paper is very noticeable with high frequency currents. Many of the peculiarities manifesting themselves in connection with condensers could be better explained if a series of exhaustive tests were made relating to capacity as dependent upon the dielectric and the conditions governing the construction of a condenser. At present only rough estimates can be made of their proportions that poseess but an arbitrary value.

THE THREE PHASE INDUCTION DYNAMO.

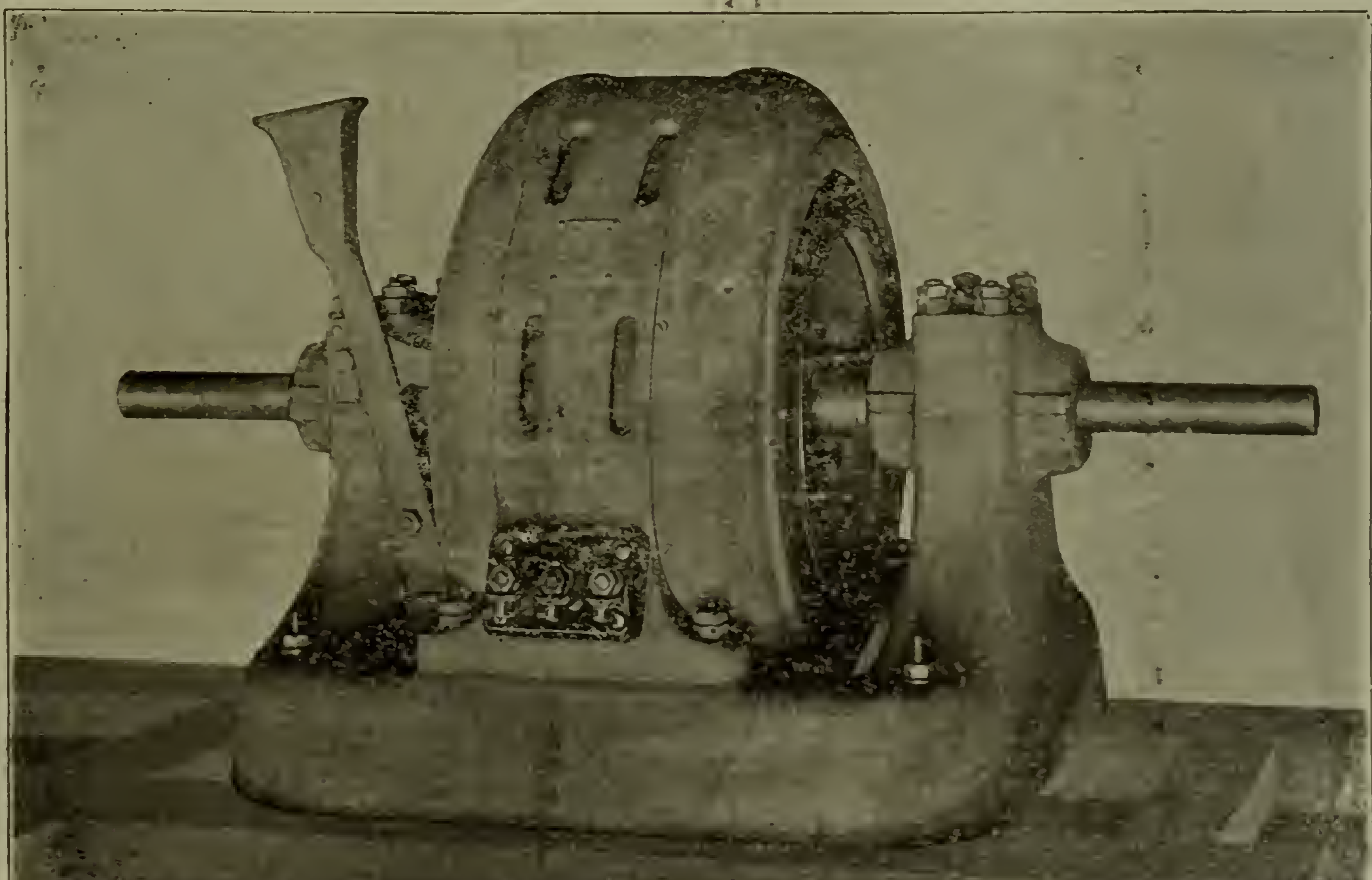
The properties of rotating magnetic fields have been so universally recognized by Tesla and Dobrowolsky that the largest manufacturers of electrical machinery have made them a matter of special observation.



(II) Curves of Condenser Tests.

"Some years ago Mr. William Stanley, of Pittsfield, Mass., introduced a polyphase alternator of the inductor type in which the whole of the copper windings, both primary and secondary, are fixed, the only moving part being iron."

Distinct advantages accrue from this method of construction, the care and first cost of a plant being considerably reduced and the commercial benefits quite self-evident to the up-to-date engineer. In the illustration a type of three phase alternator is depicted whose serviceability will reach over a period of many years and in which care and cost are reduced to a minimum.



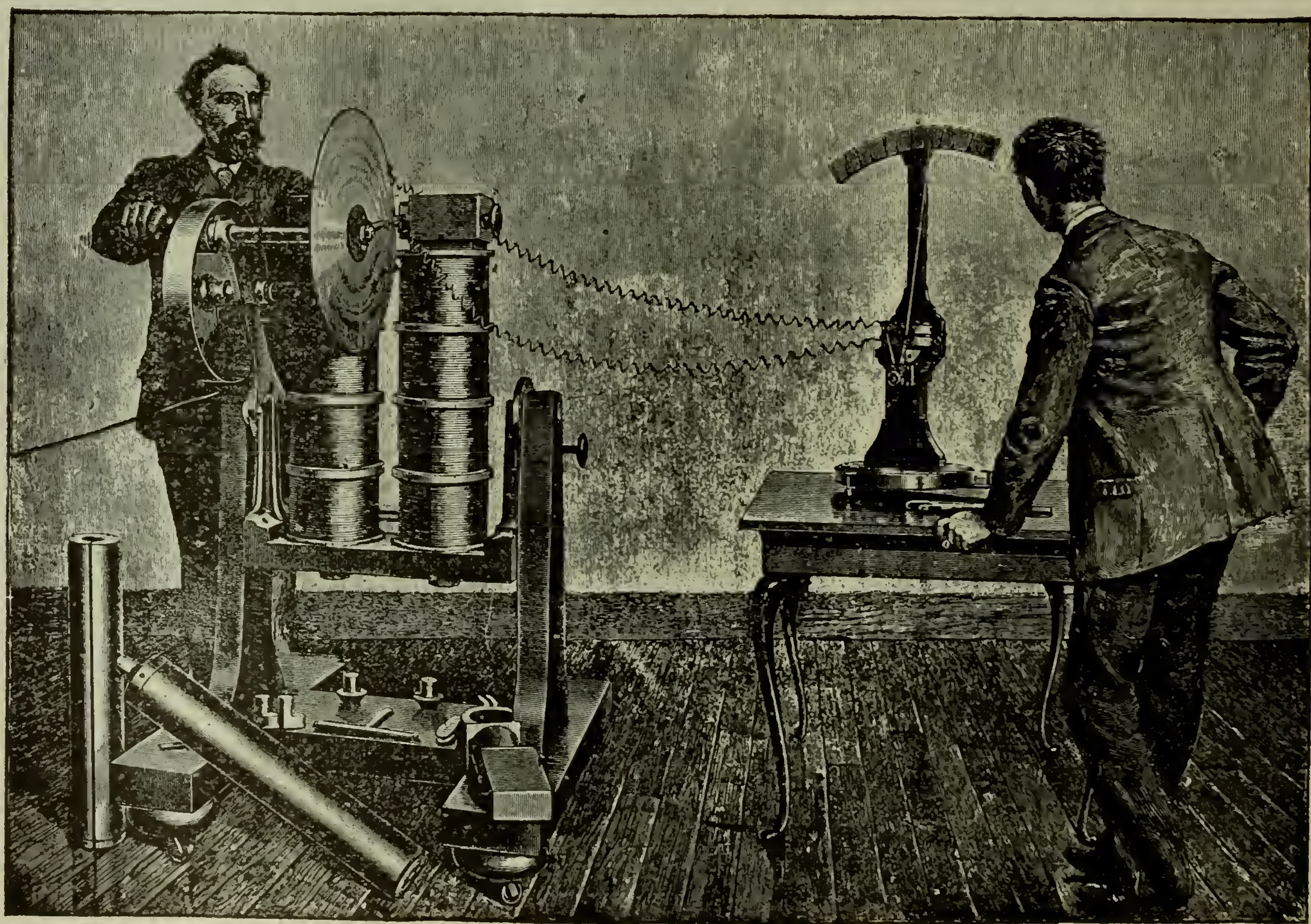
Stanley Induct Generator.

DISK DYNAMOS.

The delineation of the famous expermient of Arago, Faraday and others is represented below by a large disk of copper rotated

Standard Size Sturtevant Blower.

between the poles of a powerful magnet and connected to a huge ent indicator. In an experiment of this kind the electro



The Famous Experiment of Faraday.

magnets are energized or demagnetized by the turn of a w[illegible]ch. If the handle is grasped and the copper disk rotated [illegible] the magnets are operating, the copper disk whirls round at a high speed. The instant current passes through the electro magnet it becomes an exceedingly difficult to continue the rotation even slowly. While the disk is being spun under these circumstances the needle swings over acting, as it were, as an exact register of the physical effort made by the experimenter.

Disk dynamos are commercially applied in England for the generation of heavy currents used in electro plating. The electro motive force is exceedingly low but the simplicity of construc-.

tion, low price and relatively high efficiency make them of some consequence in the commercial world. With a smaller size disk dynamo than that represented the difference in magnetic permeability of various samples of iron can be well tested by substituting them for those already employed. The changes in the magnetic field are immediately felt by the individual turning the disk: a high permeability core, calling for more physical effort in turning the disk than one of low permeability.

VENTILATORS.

The warm wave will soon be here and restaurant keepers, hotel men and places of public amusement will be called upon to ameliorate the sufferings of those supplying them with patronage. The Sturtevant fan for either exhaust or pressure blowing, which has for many years held supremacy in its special field of work, is ready for delivery to those anticipating their use.

In connection with small electric fans whose main use is that of supplying a local breeze, a large exhaust or pressure blower installed in either kitchen or basement will certainly add to the comfort of those engaged there and thereby increase their working ability. The power consumption and its subsequent cost is small compared with the direct advantages their use implies. B. F. Sturtevant Company have their factory in Boston, Mass.

MISCELLANEOUS.

STRAY CURRENTS.

A MAGNETIC OUTPOST.

A small magnetic pavilion set up in Greenwich Park, England, at a distance of 300 or 400 yards from the Observatory has been at work for some weeks past. This little scientific outpost was found necessary in consequence of the disturbing effect upon the instruments of the large amount of iron which enters into the composition of the new Observatory buildings.—Ex.

GAS V. ELECTRICITY.

A director of an English gas company informed the shareholders recently that "he thought that the changes in gas lighting introduced during the past few years had been so great that electricity would have considerable difficulty in coming to the front." The speaker sees through a glass darkly.—Ex.

VACUUM DRYING OF DYNAMOS AND MOTORS.

In Germany the leading electrical firms are said to dry their insulations at a low temperature by means of a vacuum. Placed in vacuo, water evaporates at correspondingly low temperatures. In a vacuum of 28 inches, for example, a temperature of 35° C. (95° F.) will soon dry off any moisture, and even at 63° F. very thorough drying can be effected in a good vacuum, as a glance at a table of the properties of steam will render obvious.—Ex.

INSULATORS FOR LOW TEMPERATURE WORK.

To maintain extremely low temperature by means of freezing substances requires careful insulation. Prof. W. Hempel finds that eider-down is the best insulator, carefully dried wool being nearly as good and cheaper, and that both are much better than the specially devised vacuum-jacket tube of Prof. Dewar. "Invention" says that starting at about 110° below zero F., the rise in temperature under protection of the eider-down was only 22° in 88 hours, while in the Dewar tubes the increase was 70° to 124°.—Ex.

AN EXTINGUISHER FOR OILS.

To extinguish oils which have taken fire, the Illustrirte Gewerbe Zeitung recommends the use of a fine-meshed wire-net of the size of a boiling-pan, which should be kept in every varnish factory, etc. In the same moment when the netting is laid upon the burning surface, the flame is extinguished because it is a glowing mass of gas, which the iron wire quickly cools off so much that it cannot glow any more. The use of water is excluded, and that of earth and sand undesirable, because both dirty the oil.—Ex.

THE CARLIN TUBE.

In the "Journal of the Chemical and Metallurgical Society of South Africa," Vol. 1, page 63, we notice a paper by A. von Dessauer on the Carlin tube. The tube consists of an ordinary iron pipe, ½-inch in diameter, closed at its ends with screw plugs and filled with mercury. As many holes as there are electrodes are drilled in the top, from end to end, as it lies horizontally, of sufficient size to allow the copper connecting wire to pass through easily and dip into the mercury. The electric main is affixed to one or both of the end plugs in a convenient manner. The pipe may also be made of copper or brass, when there will be a risk of amalgamation; or it may be replaced by a solid iron rod with one long groove, or a series of small cavities to hold the mercury. With this system of connection there is practically no loss of tension of current, experiments showing, with an 8-feet tube with 52 cathode connections, a loss of only 0.3 per cent. as compared with a loss of 18.4 per cent. with the ordinary mercury trough connection. The intensity of current is evenly distributed, and the connection is rapid and perfect, and without the possibility of becoming dirty or oxidized. Furthermore, there is no heating of the mercury nor loss by evaporation or spilling.

THE TELEPHONE.

NEWS FROM THE TELEPHONE FIELD.

The advance sheets of the consular reports present statistics showing that the world has in use 1,288,163 telephones, with 1,509,499 miles of distance covered. The United States leads, with 772,627 telephones, followed by Germany, with 151,101; France, with 27,736 (in 1894); England, 69,645 (in 1894); Sweden, 56,500; Norway, 20,678; Canada, 33,500; Switzerland, 28,846. Russia is but poorly equipped, with 18,495.

Professor Alexander Graham Bell is reported to have said that his father "invented a symbol by which deaf mutes could converse and he invented an apparatus by which the vibrations of speech could be seen, and it turned out to be a telephone." In trying to make a machine by which it would be possible to hear vibrations, Professor Bell was advised by an artist to take the human ear for his model, the artist supplying him with a dead man's ear. Upon experimenting he found that the dead man's ear wrote down vibrations, and concluding that if iron could be made to vibrate on a dead man's ear a yet better instrument could be made. "So the telephone arose from these attempts to make the deaf speak." The Professor further said that it was not his knowledge of electricity that brought this result, but his experience in teaching the deaf.

The latest thing in the way of telephone equipment, says the Concord, N. H., "Monitor," is being exhibited to Concord people by the New England Automatic Telephone Company, who have established a model exchange at No. 88 North Main street with a view to demonstrating the possibilities of what is hailed as "the telephone of the future." The new system is certainly unique. It requires no "hello girl" to operate it, each instrument making its own connection and release automatically. Moreover, it is absolutely secret. A telephone once being connected it is impossible for any other instrument to cut in and listen to the conversation over the line, even the Central being debarred from sharing in the news that passes over the wire. In addition there is no delay in making the desired connection.

The bill of Senator Wolfe, of California, to regulate telephone charges, fixed the following maximum rates: In cities of 100,000 inhabitants, $2 a month; 30,000 inhab-

itants, \$2.80; 15,000 inhabitants, \$3; 10,000 inhabitants, \$3.25; 3,000 inhabitants, \$3.50; less than 3,000, \$3.75. The charge at public and pay stations for local messages or conversation shall not be more than 5 cents for each five minutes after connection is made. The Clerk of the Supreme Court, the State Controller and the State Treasurer are constituted a telephone commission to fix charges for long-distance telephoning and to modify local rates. Telephone companies shall be entitled to 7 per cent. on their investment, and the commission may raise rates accordingly.'

The Bethany (Ill.) Echo, speaking of using barbed wire fencing for telephone lines, says: "Thomas Crowder, who lives a mile and three-quarters north of town, has such a line. A telephone wire connected with W. H. Logan's store and also with the local central office, runs out to the edge of town and is fastened to a barbed wire on a fence. The wire runs up to a road just in front of the house, and the wire is fastened up in a hedge tree and crosses the road. It is then attached to the upper porch of the house. It is used all the time."

The Atlanta (Ga.) Journal says: "The Southern Bell Telephone and Telegraph Company was awarded a verdict of \$500 in its damage suit against the Atlanta Consolidated Street Railway Company. The suit arose from an accident on South Pryor street in the summer of 1893. A trolley from one of the railway company's cars slipped and broke a wire of the telephone company. The telephone wire fell on the trolley wire and a heavy charge of electricity was conducted to the telephone exchange, at the corner of Broad and Marietta streets. A fire resulted, damaging the exchange to the extent of \$2,300. In charging the jury, the judge said that though both corporations were to blame, the telephone company was the least culpable."

ELECTRIC RAILWAYS.

AN OPENING FOR ELECTRIC RAILWAYS IN SANTIAGO DE CUBA.

Writing from Santiago de Cuba, a correspondent of the Chicago Record says: "Santiago has no means of street traffic save by ancient carriages or hacks, and a street railway undoubtedly would be a paying institution. The climatic influences are such as to make the inhabitants lazy, no matter whether they have lived here long or not, and they all detest walking. It costs \$1 to ride in a carriage to any part of the city no matter if the distance is one block or 20 blocks. On account of the hills and the hot climate a street railway would necessarily have to be operated by electricity or other mechanical power, as it would be impossible for mules or horses to pull the cars up the grades."

THE STORAGE BATTERY.

PUMICE STONE IN STORAGE BATTERIES.

One of the most ingenious innovations in the manufacture of storage cells is the use of granulated pumice stone with the lead from which the storage plates are molded. This method is in use in at least one factory in Germany which turns out about 50 tons of batteries per day. The heat from the molten lead expands the air contained in the pores of the pumice stone, thus creating an infinite number of cells throughout the mass of lead. It is said that a plate nine by seven and one-half inches, thus treated, is porous enough to absorb five and one-half ounces of water. This pumice stone may be removed if desired, but since it is electrically inert and there is only about 10 per cent. of solid matter, its presence is of little account, one way or the other. An enormous range in weight and porsity is available by this method and it is hoped that the use of this spongy form of lead will permit a return to the simpler Plante-type of cell. There is a large natural surface of active material, regardless of the thickness of the plates, in this new spongy cell and it is held with absolute security in the innumerable pockets of the body of the plate.

LEGAL.

WESTINGHOUSE COMPANY SEEKS TO ENJOIN THE GENERAL ELECTRIC COMPANY.

Wall street was interested in the news, says the New York Sun, that the Westinghouse Electric & Manufacturing Company had instituted a suit at Utica in the Circuit Court of the United States for the Northern district of New York to enjoin the General Electric Company from delivering multiphase apparatus covered by the Tesla patents to the Edison Electric Illuminating Company. The step taken by the Westinghouse company raised the question in Wall street as to whether or not a rupture had occurred in the relations between that company and the General Electric Company. It also led to selling of General Electric stock, which was weak in consequence.

The suit, it was stated, was brought under the agreement relating to patents which the General Electric Company and Westinghouse company entered into in March, 1896. Under this agreement the patent rights of the two companies were understood to have been pooled.

The Westinghouse company in the present suit contends that the apparatus in question, which is used in alternating current work cannot be delivered by the General Electric Company, because of the exclusive license under the Tesla patents which the Westinghouse company's licensee in this city, the United Electric Light & Power Company, has held for many years. The motion for a preliminary injunction is returnable on April 4.

It was stated at the Westinghouse company's office, 120 Broadway, that the suit had been brought to have it settled whether or not the rights of licenses should be respected, and that it did not mean that the two big electric companies had again gone to war or that the pooling agreement had been abandoned.

A dispatch to the New York "Sun" states that J. Pierrepont Morgan, the New York banker, has promised to contribute £5,000 to the cost of establishing an electric illuminating system in St. Paul's Cathedral, London.

The old saying, "How have the mighty fallen," is aptly illustrated by the following, taken from an exchange: One hundred shares of Keeley motor stock were recently sold at Hoboken at auction for three dollars and a half.

An exchange notes that as Marseilles, France, glass tubes are being used as underground conducts for telegraph wires and for carrying electric light wires in factories, theatres.

A farmer stopped in front of a Michigan City electric plant and asked a bystander:

"What is that 'ere-building, a factory?"

"No, a plant;" was the answer.

"What do they raise there?"

"Currents," replied the quick-witted bystander.

"What are they worth a bushel?"

"We sell them by the shock."—Ex.

BUSINESS NEWS

"TELEPHONE CATALOGUE AND STUDENTS' MANUAL."

We have just received a copy of the seventeenth edition of the "Telephone Catalogue and Students' Manual," published by J. H. Bunnell and company, 76 Cortlandt street, New York, manufacturers of telegraph and telephone supplies. This is the twenty-first year of the organization of this famous house, having been established in 1878. The composition of the firm contains the ideals of practical men in all its integril branches, being the creators of the best telegraph apparatus; the telegraph fraternity depending upon them for their supplies and information on this subject. This latest work issuing from their literary department cannot be too highly praised or too highly appreciated by electricians, contractors, wiremen, and novices. It contains the fundamental principles of the telephone and telegraph. The first pages are devoted to instruction and the operation of telegraph instruments. The language is so simple and instructive that a novice can become an efficient operator in a short time. The illustrations clearly demonstrate the connections of the apparatus so that any one can set them up. The Morse alphabet is set forth in a manner easy to grasp and retain. The work contains illustrations of all styles of telegraph apparatus and intruments for testing. A full line of telephone apparatus is shown for long distance, short line, private, factory, office and general interior uses. Diagram illustrations give a clear idea of how to set up short lines of telephones for private or public use. The interior telephones illustrated in this work are shown in a number of styles and are made of the best material and finished in the very best manner commensurate with the reputation of the firm. The work contains a large line of general electrical goods in every day use, fully illustrated and described and the volume throughout is complete in every detail, surpassing all previous efforts in the publication of these manuals. Copies of this manual will be sent free on application.

SPECIAL EXPORT COLUMN.

ELECTRICAL EXPORTS FOR WEEK ENDING MARCH 14, 1899, $43,465.00.

New York, N. Y., March 14, 1899.—The following exports of electrical material are from the port of New York for the week ending this date:

Antwerp—3 cases electrical material, $30.

Alexandria—45 cases electrical machinery, $7,620.

Berlin—4 cases electrical machinery, $1,300. 7 cases electrical material, $60.

Brussels—2 cases electrical material, $3.

British West Indies—53 packages electrical matter, $1,108.

Brazil—11 packages electrical matter, $1,051.

British Guiana—7 cases electrical matter, $309. 1 case electrical machinery, $80.

British Possessions in Africa—7 packages electrical material, $691.

Cuba—38 packages electrical material, $1,125.

Chili—161 packages electrical material, $6,126.

Central America—60 packages electrical material, $345.

Dublin—41 packages electrical material, $7,188.

Elizabethgrad—11 cases electrical machinery, $1,479.

Glasgow—11 cases electrical material, $1,899.

Genoa—3 cases electrical material, $85.

Havre—12 cases electrical machinery, $1,070. 4 cases electrical material, $143.

London—220 packages electrical material, $8,622. 6 packages electrical machinery, $195.

Mexico—65 cases electrical material, $660.

Milan—2 packages electrical material, $73.

Moscow—3 cases electrical material, $143.

Newfoundland—1 case electros, $15.

Odessa—30 cases electrical material, $750.

Peru—12 packages electrical material, $929.

Rome—5 packages electrical material, $302.

Santo Domingo—5 cases electrical material, $28.

Venezuela—1 case electrical machinery, $13. 27 cases electrical material, $623.

NEW INCORPORATIONS.

Alexandria, Va.—National Electrical Supply Co., incorporated by Henry D. Merrick, president; Moreli Mareau, vice-president; Edwin C. Graham, secretary and treasurer; electrical apparatus. Capital stock $25,000.

Chicago, Ill.—Sunlight Gas Light Co. has been incorporated by D. W. Clendenin, Wm. McAuley and W. H. Vaughan; gas and electric fixtures. Capital stock $2,500.

New York, N. Y.—Knickerbocker Electrical Maintenance Co. has been incorporated by Louis B. Jennings, W. W. Bonneau and W. G. Cochrane. Capital stock $10,000.

Auburn, N. Y.—Universal Light, Heat and Power Co. has been incorporated by R. H. Huntington, J. E. Ratchford and James Devine. Capital stock $50,000.

Yonkers, N. Y.—Consumers' Electric Co. has been incorporated by F. A. Stratton, G. M. Curtis, Jr., and L. B. Lampman. Capital stock $100,000

Cleveland, Ohio.—Interstate Electric Co. has been incorporated by Fred Haffner, Master Roach, John G. Haffner; electric machinery. Capital stock $20,000.

Waterloo, Ind.—Star Electric Co. has been incorporated by Henry Taggart, Edgar B. Flack, Eli G. Flack, August L. Gruhlke and Albert L. Flack; cigar lighters and specialties. Capital stock $200,000.

Camden, N. J.—Spring Lake Electric Light, Heat & Power Co. has been incorporated by James E. Hays, George H. S. Young and John M. Fultz; electric light, heat and power works. Capital stock $50,000.

North Paterson, N. J.—Hawthorne Heat, Light and Power Co. has ben incorporated by Irvy Myers, Adam Vreeland, William H. Post, Samuel Van Blarcam, James E. Barker and Louis J. Jones; electric light. Capital stock $10,000.

New Egypt, N. J.—Eastern Water Power and Electric Power Co., incorporated by Bassler Boyer, A. H. Boyer and Jacob H. Grove. Capital stock $100,000.

Wrightstown, N. J.—Wrightstown Water Electric Light and Sewer Co. has been incorporated by Albert Watson, Sarah Newbold, Lydia A. Stockton and others, to carry on the business of an electric light company, etc. Capital stock $5,000.

Camden, N. J.—Easton Consolidated Electric Co. has been incorporated by George H. B. Martin, Wm. H. Jolley; electric light and gas company. Capital stock $1,500,000.

Portland, Me.—American Heating and Lighting Co. has been incorporated by Willis Mitchell, Chas. E. Pinkham and Frank M. Davis. Capital stock $500,000.

St. Louis, Mo.—Montana Water, Electric Power and Mining Co. has been incorporated by Paul A. Fusz, M. Rumsey, C. Jagels and L. M. Rumsey; power and electricity. Capital stock $500,000.

TELEPHONE CALLS.

Vienna, Ill.—Interior Telephone Co. has been incorporated by H. D. La Rue, J. W. Eaton, Jr., C. H. Gray; telephones. Capital stock $300

Zanesville, O.—Zanesville Telephone & Telegraph Co., incorporated by S. M. Winn, J. B. Rhodes, G. H. Southard, A. T. Brennan, J. G. England; telephone and telegraph system. Capital stock $10,000.

North Branch, Minn.—Minnesota Telephone Co., incorporated by Fred W. Murray, Helen L. Murray and others; telephone lines. Capital stock $50,000.

Johnstown, Pa.—The Johnstown Telephone Co. will

increase its capital stock from $15,000 to $100,000.

Quakertown, Pa.—A new electric fire alarm system has been established.

Bad Axe, Mich.— The Michigan Telephone Co. has recorded a $5,000,000 mortage in Huron County.

STREET RAILWAY NEWS.

Dayton, Ohio.—National Traction Co. has been incorporated by J. Q. A. Coover, A. P. Waymire, F. L. Hutchins and others. Capital stock $10,000

Kokomo, Ind.—Kokomo Railway and Light Co. has been incorporated by Fremont Woodruff, Wm. B. Stevens, Henry L. Woolfenden, L. J. Kirkpatrick and C. L. Harry; electric railway and lighting. Capital stock $8,000.

Port Huron, Mich.—A scheme is on foot to build an electric railway along the St. Clair river.

BUSINESS CHANGES.

Baltimore, Md.—The new United Railways and Electric Co. has authorized the execution of a mortgage for $38,000,000 in favor of the Continental Trust Co., to secure an issue of a similar amount of four per cent. bonds.

Trenton, N. J.—The Havana Electric Railway Co. has increased capital stock from $5,000,000 to $10,000,000.

POSSIBLE INSTALLATIONS.

Austell, Ga.—C. J. Shelverton, Mayor, may be addressed concerning erection of electric light plant.

Lees Summit, Mo.—C. A. Miller, City Clerk, may be addressed concerning erection of electric light plant.

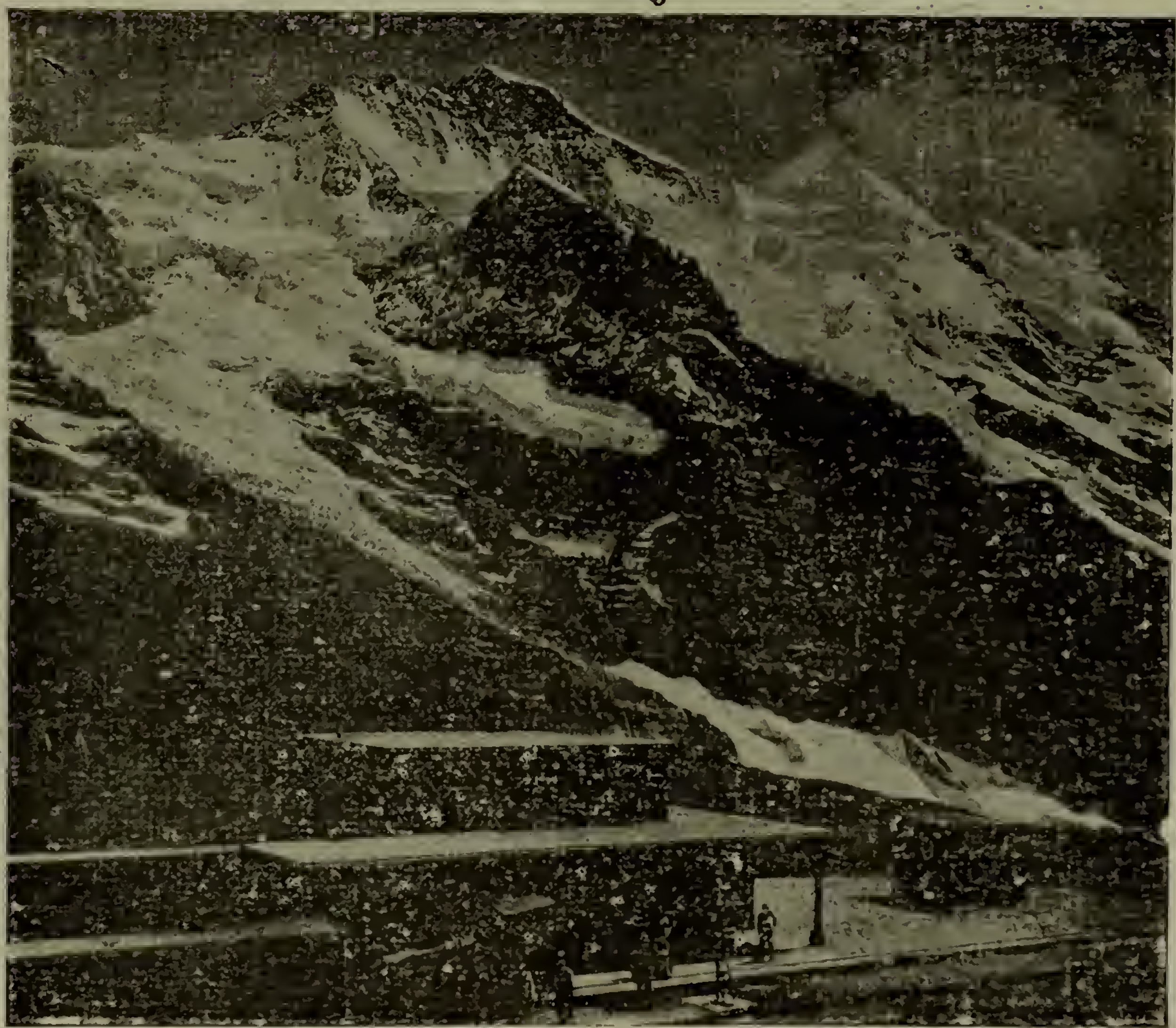
Tarboro, N. C.—John A. Weddell may be addressed concerning construction of electric light plant.

In Southern latitudes, where electric light and power transmission are apt to extend over a long reach of country, the installation of polyphase machinery adds simplicity to the operation and subtracts all factors that represent a source of worriment to either engineer in charge or proprietor.

The Electrical Age.

VOL. XXIII—No. 13 NEW YORK, APRIL 1, 1899 WHOLE No. 620

ELECTRIC RAILWAYS.



View of the Jungfrau from the Little Scheidegg Station.

MOUNTAIN ELECTRIC RAILWAYS.

By W. L. Hedenberg, editor of Electricity.

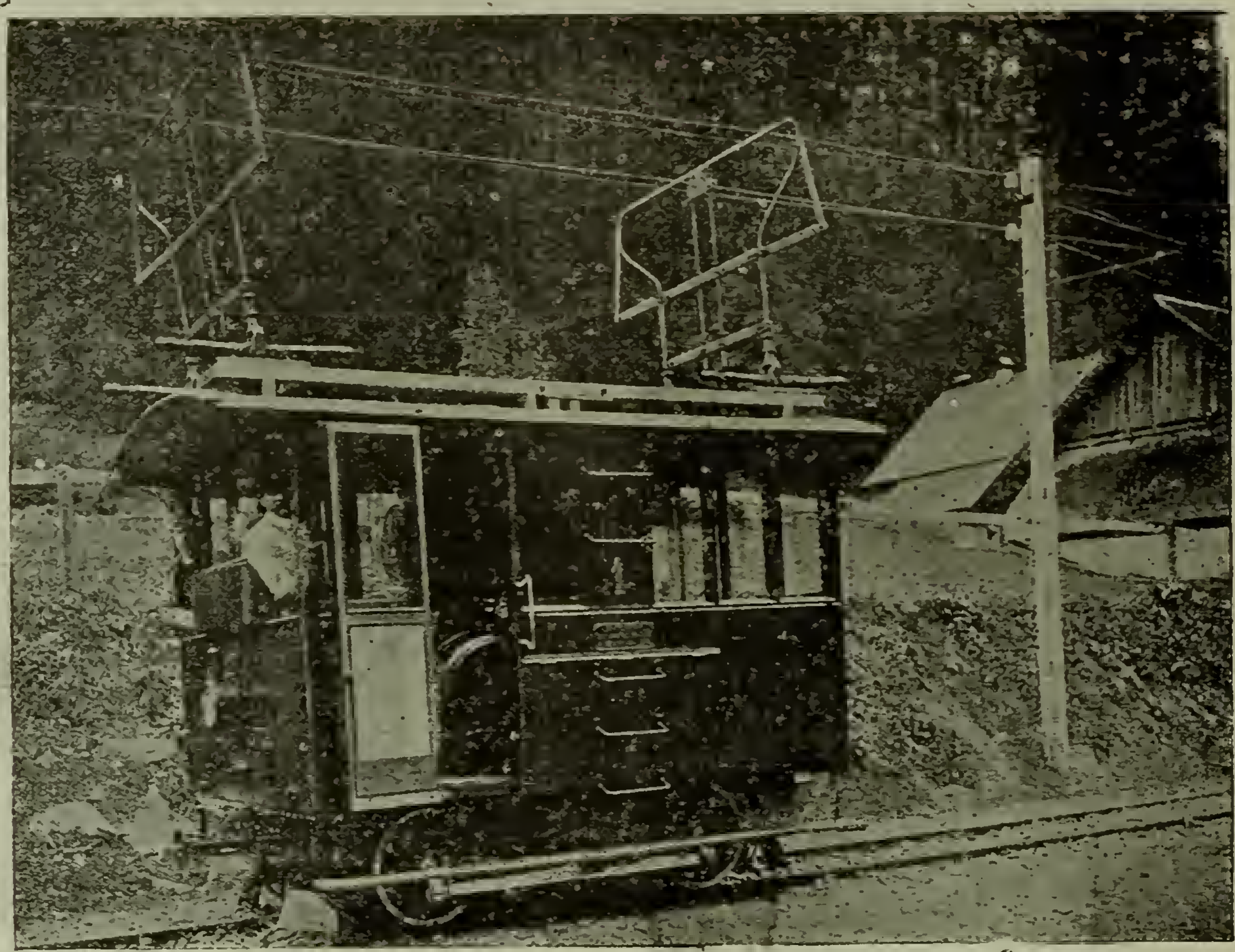
Up to the beginning of the present decade the motive power almost invariably made use of on mountain railways, either for revolving the drum on which the propelling cable was wrapped or in turning the several cog wheels on the locomotive, was steam. As however electricity as a motive power became better known, and the apparatus for generating it was perfected, it was gradually adopted in connection with mountain railways. When first made use of the principal advantage gained was the doing away with the cumbrous steam locomotives and the combining of the total requisite horse power in one central station, whereby a material saving in fuel could be effected. As direct current at a comparatively low voltage was generated, the power station had necessarily to be located in the vicinity of the road, usually at the foot of the incline, where coal could be delivered with the least possible labor and expense. At that period water wheels and turbines and means for regulating them had not reached anything like so high a state of perfection and efficiency as at present, and even allowing that water power could have been made use of for running the dynamos, nature, by a strange coincidence, must have built the line in proximity to the fall in order that it could have been economically utilized, as long-distance transmission at high voltage was then in an experimental stage. Since the de-

velopment during the past few years of alternate current transmission at high voltage, the harnessing of remote streams with a view to obtaining current for operating mountain railways has become common practice, and it is safe to assert that steam as a motive power for roads of this description will not be employed in future except in cases where no suitable water power can be procured within an available radius, which should be of rare occurrence in mountainous regions.

One of the early electrically operated rack railways is that which extends from the thriving city of Barmen, in Germany, to a neighboring forest-clad hill, the pleasure ground of the industrious inhabitants. A view of an ascending car may be seen in Fig. 1. The overhead construction on the Barmen line does not differ materially from that usually met with on trolley roads, except in the method of collecting the current, which is accomplished by means of two oblong metal frames bearing against the under side of the line conductor. Each car is equipped with two 36 HP. motors; these in the descent are converted into generators, and while tending to retard the motion of the car feed back current to the line.

by means of water power at a point on the Arve River about one mile from the railway. The plant itself consists of two sets of turbines directly connected to generators of the multipolar type, the latter developing 1,000 HP. at normal speed.

In some cases it has been found advisable, owing to topographical and pecuniary reasons, to construct mountain railways in a direct line between two points. Three such roads making use of electric power are to be found in Switzerland, namely, those of Burgenstock, Strauserhorn and Mount Salvador, and one in the United States near Holyoke, Mass., known as the Mount Tom mountain line. Another similar type of road is in course of construction in California, which will, however, not be in operation for some time yet. The principal feature of the three electrically operated cable lines in Switzerland may be seen by a glance at the accompanying table. The necessary current in each case is generated by water power at points ranging from two to three miles from where it is utilized, and is transmitted at a comparatively high potential, about 1,500 volts, over bare copper conductors secured to insulators on poles.



View of Locomotive Operated by Three-Phase Current.

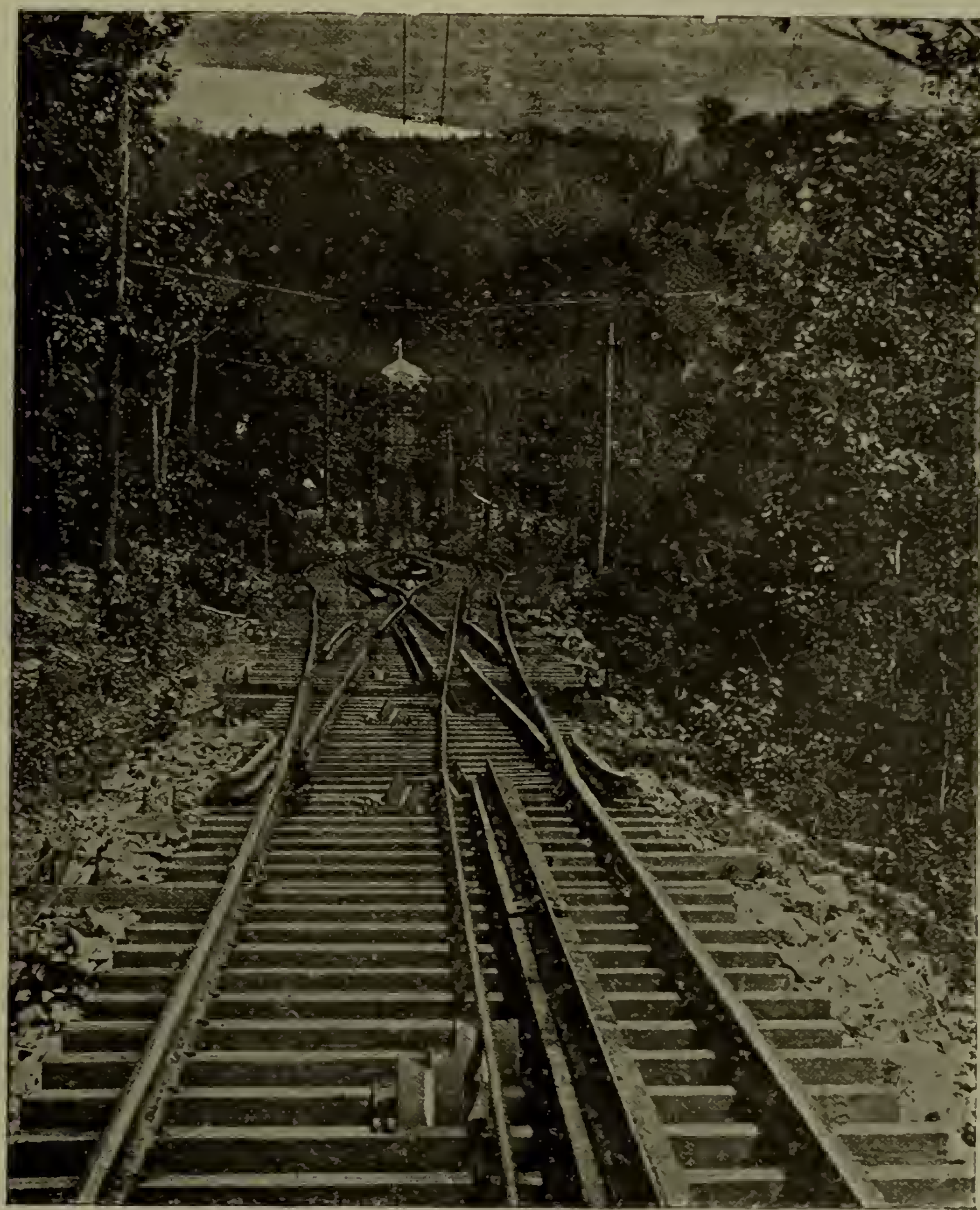
The railway running up Snaefell Mountain, on the Isle of Man, is another excellent early type of mountain railway operated by electric power.

A rather unique mountain railway in one respect is to be found near Geneva, Switzerland. This line, which ascends Mount Saleve, and is quite extensively patronized by tourists owing to the magnificent view obtainable, is about 5.6 miles in length, in which distance it rises over 2,000 feet. The well-known Abt system of rack is made use of. The cars, having a seating capacity of thirty-two, are propelled up the incline by means of two 20 HP. motors.

In Fig. 2 is shown the details of the car truck. The striking feature of this railway lies in the fact that the necessary current for operating the cars is taken, not from an overhead conductor, as is customary with railways of this description, but from a third rail located on the ties by the side of the track. This third rail is an ordinary inverted traction rail of the Vignole type, the contact shoe on the car sliding on the top of the rail base. The current for operating the cars on the Mount Saleve line is generated

In mountain railway construction the Mount Tom road is unique and undoubtedly the only one of its kind in the world. It is not so much the way in which the electric power is applied wherein this line differs from all others as in the use of the cable, with a view to economizing power and at the same time balancing the system. The cars, of which there are two, move in opposite directions, and are each equipped with two G. E. 1,000 motors, the current for operating the latter being taken in the ordinary manner from an overhead trolley conductor. To each of these cars the extremity of a $1\frac{1}{4}$ inch cable is attached, which passes over an eight inch return sheave at the upper terminus of the line. As previously stated, the cable is made use of solely for the purpose of balancing the system, the ascending car mounting the incline with its motors in parallel while the descending car has its motors shut off. Thus the dead weight of one car tends to help the other car up the grade. Another peculiar feature of the Mount Tom line lies in the construction of the turnout, which is shown

in Fig. 3. As will be seen, a single track only is made use of, deflecting rails being employed to allow of one car passing the other in lieu of movable switches. On each axle an extra pair of wheels is provided, mounted outside the journal boxes, which only support the car when the latter reaches the turnout. An arrangement of this description was found necessary owing to the peculiar use to which the cable was put and to the fact that but a single track is employed.

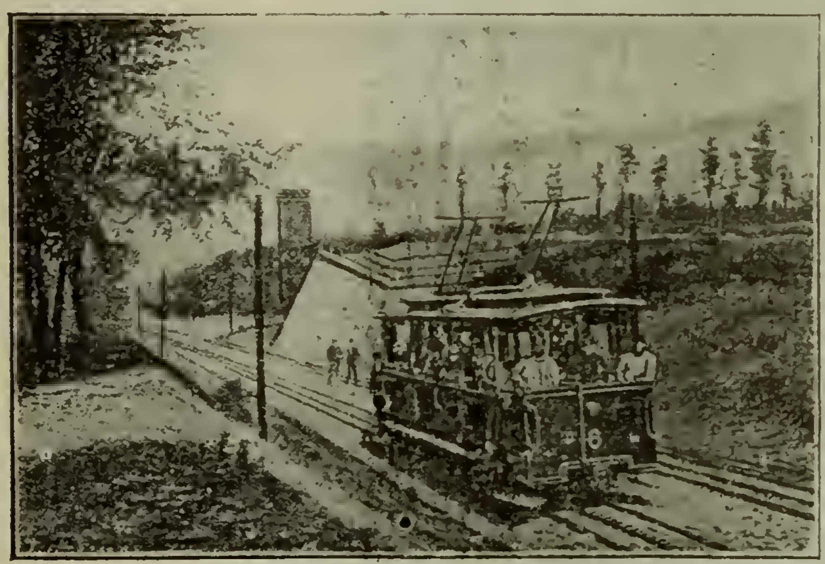


View of Mt. Tom Mountain Line.

View from the Goernergrat.

We now come to the three railways which may justly be

said to embody the most recent and up-to-date application of the electric current to mountain climbing, namely, those of the Gornergrat, Stansstadt and Jungfrau. In several respects these lines closely resemble one another; they are all operated by three-phase currents generated by means of water power, and were built exclusively for passenger traffic or with a view to conveying the thousands of tourists

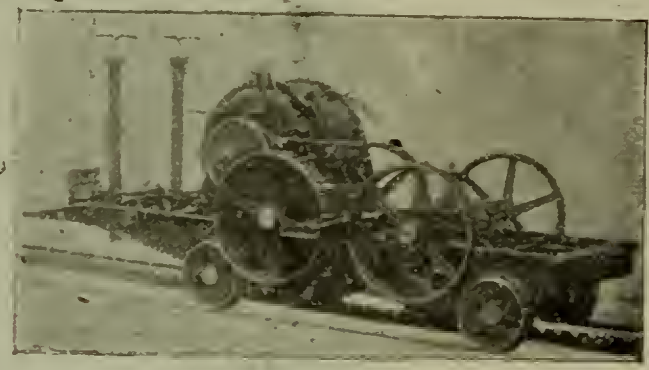


The Barmen Park Railway.

who annually visit Switzerland to points from where the grandest views of the surrounding country may be obtained.

The Zermatt Gornergrat railway was completed on August 20, 1898. The line starts from the village of Zermatt, and ascends with grades ranging from 12 to 20 per cent. to the Gornergrat, which is at an elevation of 10,791 feet above sea level. Some idea of the view obtainable from this point may be gathered from Fig. 4. The road is 5.7 miles in length, in which distance it rises 6,849 feet. The type of locomotive made use of is almost identical in construction and appearance with those operating on the first section of the Jungfrau railway and on the Stansstadt-Engelberg line. A view of the locomotive truck common to these three roads is shown in Fig. 5. The Gornergrat locomotives are each equipped with two synchronous three-phase 90 HP. motors, the current for operating the latter being taken from two overhead conductors, the track and rails forming the third branch of the circuit. The current is generated at a pressure of 5,400 volts by means of three 250 HP. water wheels of American make which operate dynamos having stationary armatures and twelve pole rotating field magnets. From the main power station the current is transmitted to three transformer stations, located at convenient points along the line of the road, where the pressure is reduced to 540 volts.

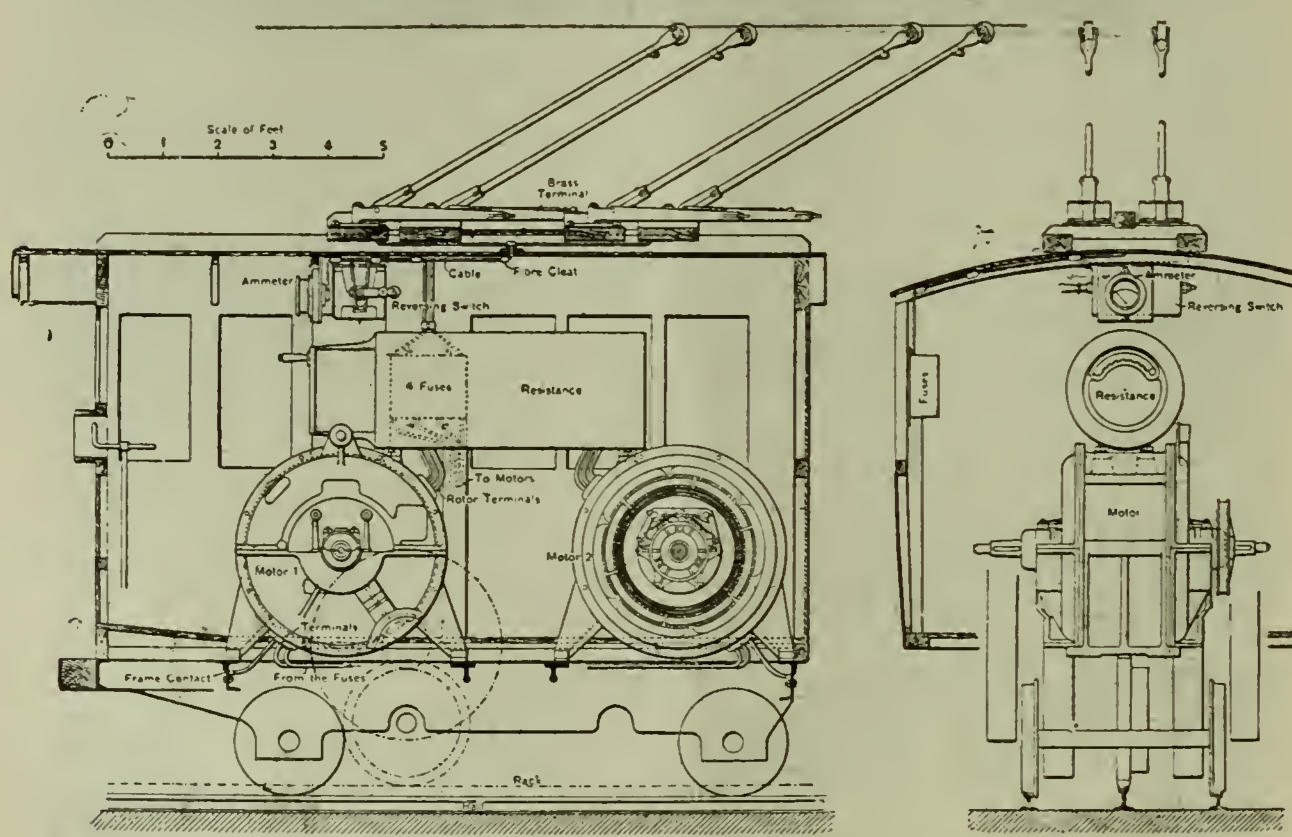
As with the other two three-phase mountain lines re-



Locomotive Truck.

ferred to, the motors on the engines in descending from the Gornergrat act as generators, and besides feeding back current to the line have a powerful braking effect. With a view to preventing the alternators at the station from running as motors in the event of all the trains descending at one time, a load resistance is provided. Each locomotive is equipped with two independent sets of brakes which effectually control the train and prevent the possibility of an accident's occurring.

The Stansstadt-Engelberg line was projected in 1890, but owing to the difficulty of securing the necessary funds work was not begun until 1897. In October, 1898, the road was completed and afforded easy access from Stansstadt, a village on Lake Lucerne, to Engelberg, a favorite tourist resort 3,480 feet above sea level. The total length of the line is slightly in excess of fourteen miles, of which however less than one mile is provided with a rack of the Riggenbach type. The locomotives used on the rack section, one of which is shown in Fig. 6, are driven by means of two 75 HP. induction motors. As in the case of the



View of Three Phase Locomotive Showing Electrical Equipment.

The Electrical Age.

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NEW YORK, APRIL 1, 1899.

CONTENTS:

THE TRANSMISSION OF IMAGES BY ELECTRICITY.

The technical name given to a device capable of transmitting pictures by electricity is the telectroscope. According to the "Journal of the Franklin Institute," "The Scientific American," and one or two other technical papers, the fundamental idea is directly traceable to the use of a selenium cell.

To quote: "as may have been anticipated the fundamental principle involved in all these devices that have been proposed for this purpose is the variation in the electrical conductivity of selenium under the influence of light of varying intensity. To demonstrate this property of selenium the simplest plan is to include a selenium cell in a telephone circuit when a sharp click will occur in the receiver every time that a bright beam of light is allowed to fall upon the selenium."

"Coming to the alleged discovery of the expert above named (Szczepanik) it is said to consist, in brief, in allowing the rays emanating from the object to fall upon a cell of selenium. Electric impulses will be produced in the selenium whose intensity depends upon the brightness of the rays falling upon the cell. These impulses being conducted to a distant receiving station are there transformed again into light. The rays falling upon the selenium are first separated into points of light by oscillating mirrors in the transmitting station. Similar mirrors in the receiving station vibrate synchronously with the mirrors of the transmitting station and reproduce the image of the object."

This very interesting, though brief review of the efforts of our worthy friend Szczepanik are sufficiently indefinite to act upon the brain in the manner that a feather would when cautiously applied to the bare sole of one's foot. To vibrate mirrors synchronously is not a difficult problem but to so regulate the flow of current that independent images are transmitted simultaneously is a problem which at present it is impossible to indicate the solution of. Another requirement of our Sclav friend is to so rotate the mirrors that a series of points are produced upon which the light rays impinge in a manner incomprehensible to either the lay mind or scientist.

To quote further regarding these mysterious mirrors, we add the following: "The mirrors are arranged in pairs at right angles, as regards their vibrations, and hence the number of points projected on the selenium in the transmitter will be equal to the product of the number of oscillations performed by each of them. If, for example, each mirror swings on its axis only one hundred times a second then ten thousand points of light will in a like period fall on the selenium and be transmitted. As a matter of fact these may number hundreds of thousands or even millions. So rapid are the oscillations of the mirror that the tenth part of a second is sufficient to analyze the image of an object in the transmitter and to render it visible at the receiving station. It is therefore possible to transmit a continuous action, such as a theatre performance, over the wires of the telectroscope since the pictures received follow one another so rapidly as to produce the impression of a moving image, just as the numerous separate pictures of a chromo—photographic apparatus reproduce past actions."

The idea of using rotating mirrors is due to the fact that any centre of illumination when rapidly rotated will produce an impression on the eye which is a fac simile of the path covered by the point of light. For instance, a spark at the end of a stick conveys the impression of a circle of light if the stick is rotated rapidly enough. Were the stick moved in the path of an eclipse, square or any other geometrical figure a corresponding impression will remain. Based upon this idea, which in itself is a satisfactory one, it is conceivable that by some peculiar arrangement of selenium cells and revolving mirrors a transmitting kinetoscope might be constructed but the distance in thought between this premise and its practical fulfillment is greater than that separating any other two foreign ideas.

Science and inventions have repeatedly proven that the alphabet which nature uses for the construction of her words and phrases is similar and more limited than our own. The action of gravitation, which is universal, has, as far as this earth is concerned, given to us a variety of forces, the conjoint and individual actions of which enable us to pass through the daily routine of our lives without the constant danger of annihilation confronting us. In other words, a few simple forces represent the foundation upon which the entire superstructure of science rests.

In the field of invention the simpler the principle upon which the apparatus if founded the more readily is the problem solved. It seems therefore as if the idea of Szczepanik, regarding the rotating spot of light, possesses simplicity which may be compared with the primitive experiment of Watt with the lid of a kettle or of Faraday with his horse shoe magnet and rotating copper disk. It is certainly true that the rapid presentation of a series of points of light will convey to the mind with exactly the same force the image of an object, whether it be present or not, but to do this so systematically and correctly that the impression is complete and perfect is a problem of such a character that the one solving it deserves to be classed with the immortals.

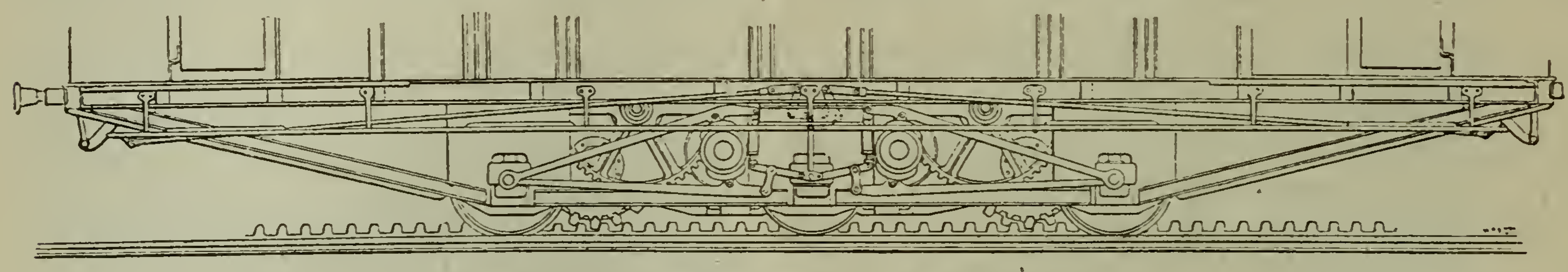
PHOTOGRAPHING LIGHTNING.

At the last meting of the Royal Photograpic Society, Mr. H. Glew showed some interesting negatives and prints of lightning flashes. His results go to prove that the duration of lightning flashes has been miscalculated, and that really a series of sparks or electric discharges pass down a given path, and not a broad stream of light.—Ex.

Gornergrat and Jungfrau railways, the distributing system consists of two overhead trolley wires, the rails forming the third conductor.

As already stated, water power is made use of for operating the generating machinery. The installation consists of two sets of turbines of 180 HP. each, directly connected to three-phase dynamos with revolving armatures and which generate current at 750 volts.

The Jungfrau electric railway starts from what is known as the Little Scheidegg station, a view of which is shown in Fig. 7, and ascends as yet only to the Eiger Glacier station, a distance of 1.2 miles, the remaining portion of the line being in course of construction. The equipment of the now almost completed power house consists of two generating sets of about 500 HP. capacity each. The dynamos, which generate three-phase currents at a pressure of 7,000 volts, are directly connected to the turbines, which are of the twin Girard type. The high tension current is transmitted from the main power house to two transformer stations, respectively about four and a half and five and a half miles distant, one located at Little Scheidegg, the other at the Eiger Glacier, where by means of step down transformers the pressure is reduced from 7,000 to 500 volts. The electrical equipment of the locomotives does not differ except in degree of power from that in use on the other two three-phase mountain lines previously referred to. Each engine is provided with two 125 HP. induction motors, which, as is usual on this type or road, run as generators and feed back current to the line on descending. A sectional view of the type of locomotive common to the three railways just described is shown in Fig. 8. To insure perfect safety three independent sets of brakes have been provided, one operated by electricity and controlled automatically, a second worked by hand and which applies bronze shoes to the driving axle of the locomotive, and a third, known as an emergency brake, which can be made to grip the rack.



View of Truck and Gearing Employed on Mt. Saleve Railway.

MISCELLANEOUS.

STRAY CURRENTS.

POCKET ELECTRIC LIGHTS.

Division superintendents of the Santa Fe are investigating pocket electric lights with storage battery, the chief value being in examining dark places where it is impracticable or impossible to get a coal oil lamp. For examining trucks, etc., in wrecks after dark, this light will be of very great service.—Ex.

AUTOMATIC TELEPHONES.

By direction of the Post Office authorities in Berlin, automatic telephones are to be placed in all their offices, railway stations, and in various other places, with a view to their becoming popularised. They will be on the penny-in-the-slot principle, and for the small sum of 1d. the necessary number of minutes allowed for a brief conversation may be obtained.—Ex.

ELECTRICAL EXPERIMENTS IN FRANCE.

A Paris journal says that experiments are being made at the Ministry of Posts and Telegraphs with a new "loud-speaking" telephone. Experiments are also being made in wireless telegraphy between Nice and Cape Corso, in Corsica, a distance of over 100 miles.—Ex.

MEXICAN TRANSMISSION PLANT.

The Western Electric Company is about to install a large electric plant on the Atoyac river, twelve miles from the city of Puebla, Mexico. They propose to utilize water power from the canal constructed by Mr. Sebastian de Mier at a cost of over half a million dollars, and will install electric machinery and water wheels to transmit current to Puebla and other adjoining towns for use in factories. They will also furnish electric power for the Puebla Light and Power Company. The first installation of machinery will be 2,000 horse-power.—Ex.

THE PACIFIC CABLE.

The maximum cost of the proposed Pacific cable, inclusive of maintenance for three years, is estimated at 1,810,000 pounds, the route being from Vancouver by Fanning Island and Fiji to Norfolk Island, and thence to Queenstown and New Zealand. The rates via this route to London it is proposed should not exceed 3 shillings per word, and at this rate there is, it seems, a fair prospect that the line would pay expenses within a year of its completion.—Ex.

SILICO-CARBON FOR ELECTRIC FILAMENTS.

Th new Langhans filament for electric lamps, which is being introduced by the Premier Electric Lamp Syndicate, Limited, Huyton Quarry, near Liverpool, is said to be composed of silicon and carbon. It is not yet known whether these elements unite to form a carbide, or are merely an intimate mechanical admixture. The efficiency of the Langhans filament is somewhat below that of the Nernst Lamp, but it may be that improvements will bring it up to a higher point.—Ex.

THE MURPHY SURFACE RAIL SYSTEM.

The Railway World states that the Murphy surface rail electric tramway system has been practically tested on Manhattan Beach, Long Island, with complete success. In this system no overhead wires or open conduit are required, as the cars are supplied with current taken from a sectional rail laid flush with the surface of the roadway. The only portion of this rail which can be made electrically "alive" is the section immediately under the car, and consequently all danger is avoided. The Murphy system is far less costly than the conduit construction, and it is claimed that it can be built for the price of the overhead trolley wire system.—Ex.

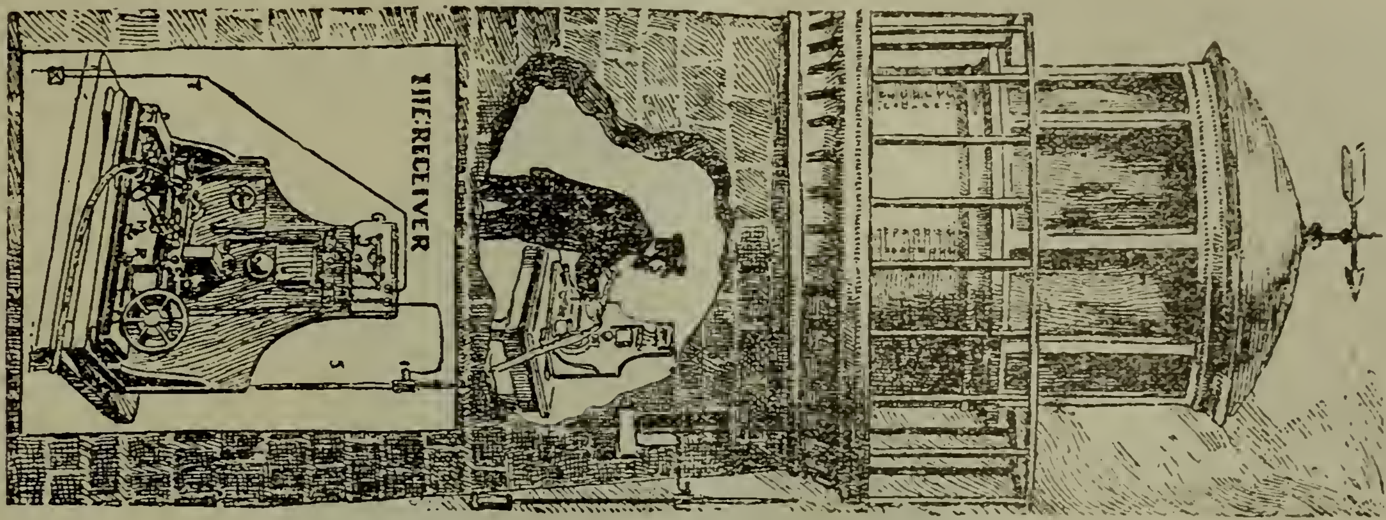
A POSSIBLE DANGER.

A short-circuit between two main feeders was recently the cause of a total breakdown at the Frankfort-on-Maine electricity works. The fault occurred at the switchboard, to which several new marble panels had been added. The current seems to have pierced one of these panels, setting fire to the woodwork of the older portion of the board, which circumstance necessitated the supply to the town cut off until temporary repairs had been effected. After a careful investigation, the probable origin of the fault was attributed to a vein of metal running through one of the marble slabs, which previous examination and insulation tests had failed to disclose.—Ex

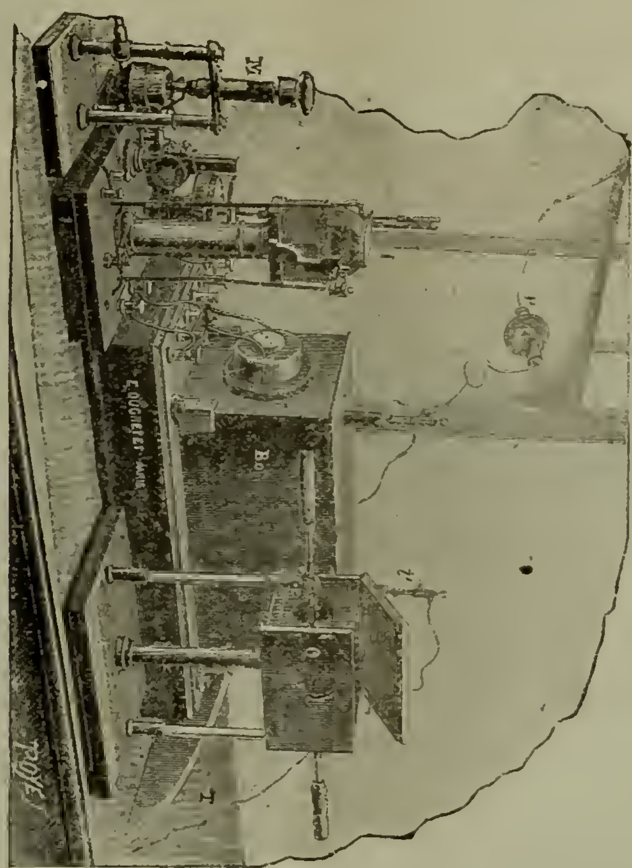
TELEGRAPHING WITHOUT WIRES.

FRENCH TELEGRAPH THIRTEEN MILES WITHOUT WIRES.

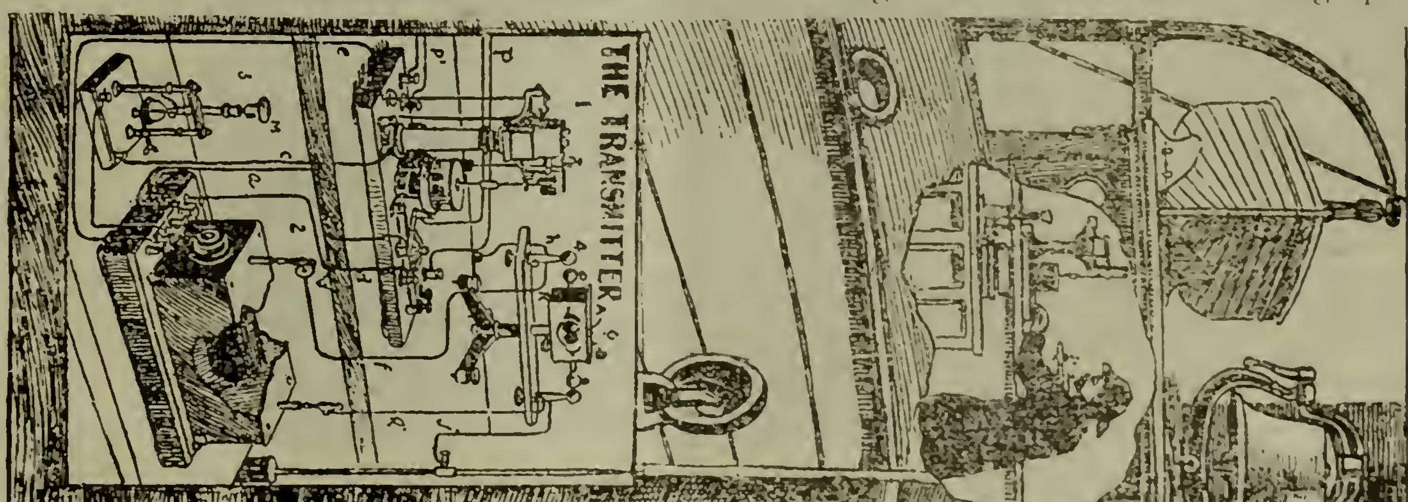
The "New York Journal" states that Ducretet can now send wireless telegraph messages a distance of thirteen miles. He is the inventor whose researches in aerial telegraphy have received the encouragement of the French Government ever since the remarkable success of Marconi in England.



In the South Foreland Lighthouse.



Ducretet's Transmitter.—(Through the courtesy of the "Literary Digest.")



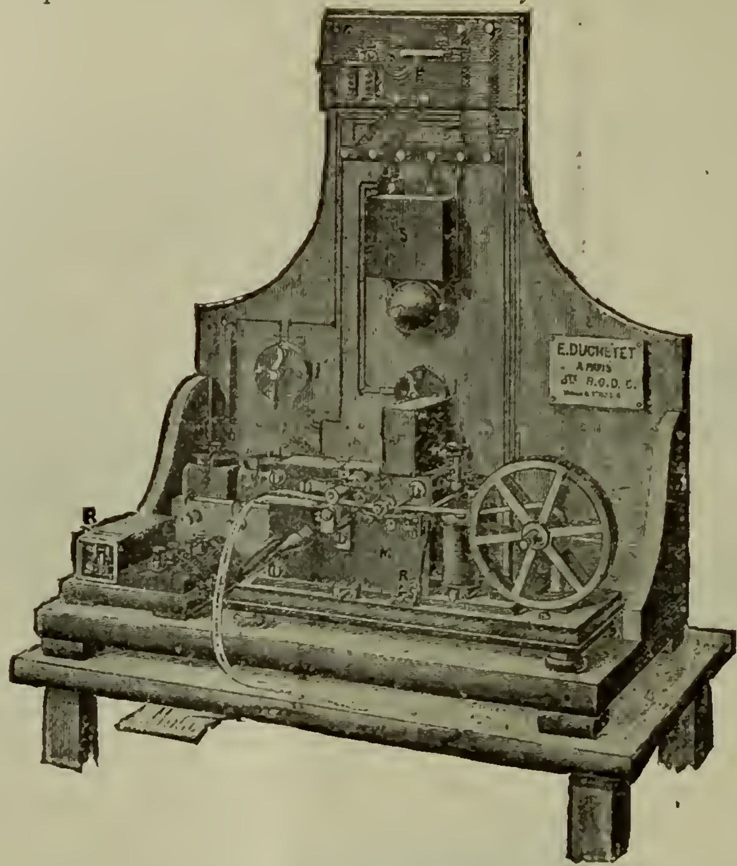
In the East Goodwin Lightship.

U. S. Consul General Gowdy, at Paris, had received instructions from Washington to keep the Government informed of French progress in this important branch of invention, and he applied to M. Ducretet for a summary of his discoveries. In reply, the electrician communicated the above fact, adding that his messages are dispatched and received at the summits of masts 99 feet high. He says that he has accomplished, in the face of great difficulties, the automatic registration of messages.

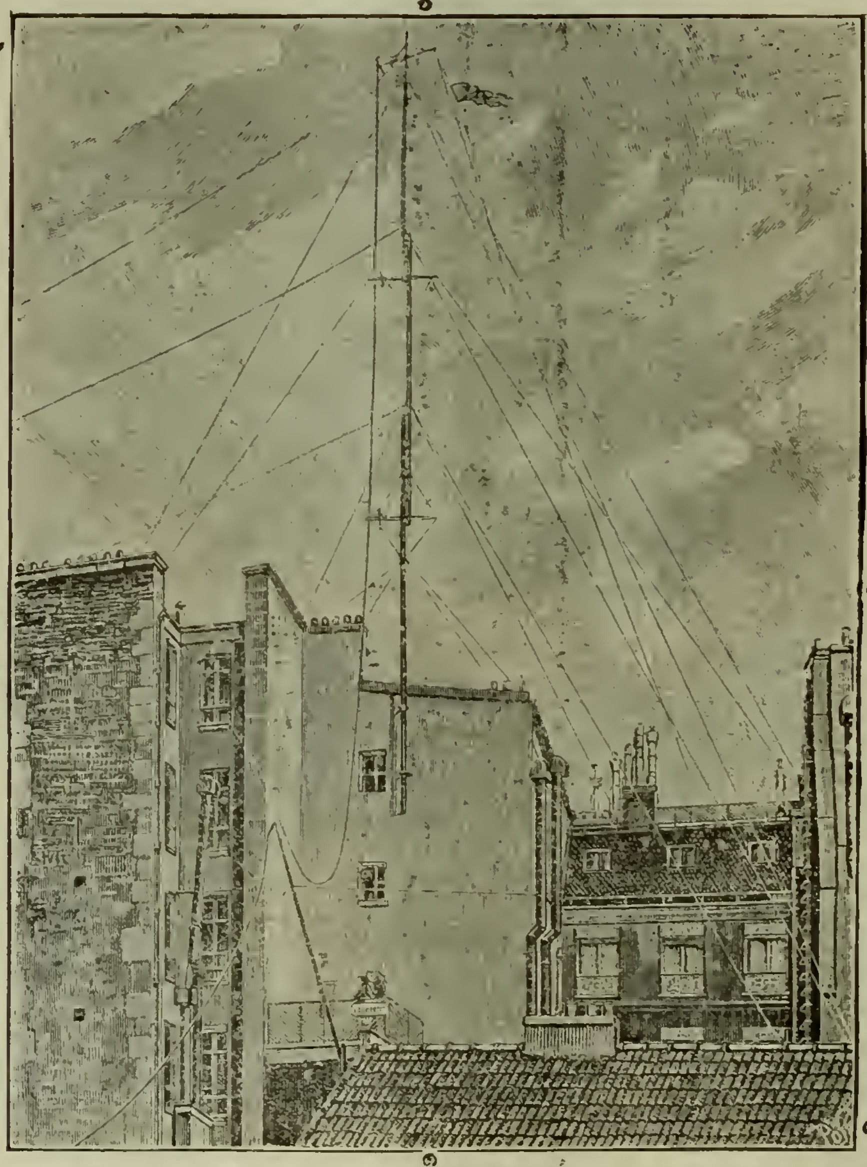
The arrangement of M. Ducretet's telegraphic apparatus is as follows: The mast supports one of the ends of an insulated conductor that floats in the air, while the other end

communicates at P (see Fig. 1) with the pole of an induction coil and one of the spheres of discharge. The other pole of the coil is connected with the other sphere and then to earth. If the electric current passes through the coil a discharge takes place between the two spheres, which constitute what is called the 'oscillator.' Thus we have a discontinuous and oscillatory electric discharge, a source of electric waves.

"From the free extremity of the insulated conductor fixed on the mast the waves radiate. This extremity may be terminated by a metallic surface, that furnishes, together with the conductor, the requisite electric capacity. This radiating conductor is, then, the transmitter. A spring key, M, enables us to make the discharge short or long as the Morse transmitter, with this difference, that there is no line between the transmitting and the receiving station.



Ducretet's Receiver.—(Through the courtesy of the "Literary Digest.")



Station in Rue Claude Bernard.—(Through the courtesy of the "Literary Digest.")

"The receiver consists of a 'coherer' or tube filled with metallic filings (Br), called by Branly a 'radioconductor,' of a model invented by M. Ducretet; this is put in communication on one side with the insulated conductor of a second tall mast and on the other with the earth. The end of the insulated conductor is the collector of the electric waves. On the other hand, the cohering tube is placed in the circuit of a battery and a very sensitive telegraphic relay R. The battery current passes in the electro-magnet of the relay only when the electric waves, coming through space, traverse the 'coherer' causing it suddenly to become a conductor. This conductibility is destroyed by a slight shock, which an automatic tapper F, actuated by a magnet (like that of an electric bell) gives at the moment when the current passes. It is this discontinuous conductivity that is utilized for the collection of the waves. . . . . . .

"As in all kinds of telegraphy, each station must have both transmitting and receiving instruments. The mast and its insulated conductor serve, by the use of a commutator, successively as transmitting radiator and as collecting receiver of the waves. A portable receiving instrument suffices for the reading of the Hertzian signals by sound; by connecting it with a registering apparatus the message may be printed on a band of paper. Such a message may be said to 'fall from heaven.'

"Experiments with these telegraphic devices have been made with the great mast in Rue Claude-Bernard, whence messages were transmitted to the Pantheon, and afterward between the latter place and the Eiffel Tower, a distance of 4 kilometers (2½ miles). These messages were always sent successfully over Paris in spite of rain and fog. At this moment experiments are on foot on the French coast, the distance between the two stations being 30 kilometers (19 miles). . . . . . .

Wireless telegraphy made enormous strides last year in Europe. Although it has been experimented with in this country with more or less success, it is doubtful if any Americans realize that a system covering a distance of twelve miles has been in practical operation off the English coast all the winter.

This is between the South Foreland lighthouse and the East Goodwin lightship. By the use of Marconi's system messages are flashed continually from ship to shore and vice versa without the aid of a wire. In this way many lives and much valuable property have been saved, since it has been possible for the men tossed in the lightship to communicate to those on shore the plight of vessels that have ventured too close to that graveyard of good ships, the Goodwin Sands. This was notably the case several months ago when the large ship Elbe went aground.

Professor Marconi, the most successful of the many experimenters who have worked on this problem along identical principles, is only twenty-five years old, and his researches have already won him a fortune. He began the work in Italy, his native country, and the Italian Government hastened to pay him a handsome price for his invention for use on war ships. Then the young professor went to England, where he was received with open arms. The lighthouse lightship equipment is one of the results of his sojourn in England.

Confident that he could transmit messages a much greater distance than twelve miles, Marconi proposed to establish communication of this kind between the English and French coasts, but the French Government for a long time withheld its consent from any such enterprise. Viewing the progress of wireless telegraphy in England and Italy, however, and the fact that the German Emperor was dabbling in it for the benefit of his army and navy, the French Government at length withdrew its opposition to the trans-Channel system, which Marconi is now working at, and at the same time gave its assistance and support to a native inventor, M. Ducretet, who had been working along the same lines without much encouragement.

A press dispatch from London states that Signor Marconi has succeeded in transmitting messages without wires across the English Channel, between England and France, a distance of about thirty-two miles.

TABLE DIMENSIONS, &c., CROCKER-WHEELER MOTORS.

Horse Power	Net weight lbs.	Speed	Pulley: "P." Diameter ins.	Pulley: "F." Face ins.	Size of Motor over all: "L." Length ins.	Size of Motor over all: "B." Breadth ins.	Size of Motor over all: "H." Height ins.	"G." Length between bolt holes in base	"E." Breadth between bolt holes in base	Diam. Shaft ins.	"D." Diam. Armature ins.	"C." Height of shaft centre from base of Motor
1/12	13	2,100	Grooved, 1½ or Flat, 1½	⅞ / 1	7[illegible]	5½	7[illegible]	4[illegible]	2[illegible]	[illegible]	3[illegible]	5 11/16
1/8	26	2,000	Grooved, ½ or Flat, 1½	¾ / 1	9[illegible]	7½	8[illegible]	6[illegible]	3[illegible]	[illegible]	3[illegible]	6[illegible]
1/6	26	1,800	2½	1[illegible]	9[illegible]	7½	8[illegible]	6[illegible]	3[illegible]	[illegible]	3[illegible]	6[illegible]
¼	65	1,500	3	2	14[illegible]	9½	10[illegible]	9[illegible]	4[illegible]	[illegible]	4[illegible]	7½
½	100	1,350	3½	3	13¾	11	13	11½	5[illegible]	1[illegible]	5[illegible]	9
1	157	1,050	4	3½	19	13[illegible]	15½	12[illegible]	7	[illegible]	7 1/16	10½
2	290	1,050	6	3	25	15⅝	18[illegible]	13[illegible]	9[illegible]	1	8[illegible]	11 7/16
3	300	1,000	6	4	26¼	15⅝	18[illegible]	13[illegible]	9[illegible]	1	8[illegible]	11 7/16
5	485	1,000	7½	4½	2[illegible]	18¾	21	1[illegible]	9[illegible]	1[illegible]	9[illegible]	12¾
7½ } Special.	....	....	....	....	....	....	....	....	....	....	....	....
10 } Special.												

ELECTRO TECHNICS.

DIMENSIONS OF MOTORS.

In the following table may be found various dimensions of Croker-Wheeler motors, ranging from one-twelfth to one horse power. The diameter of pulley, weight and speed

of each size respectively is likewise given. The value of this table is obvious to those who are engaged in calculating the various dimensions of motors and generators whose horse power does not exceed that given in the table. One of the difficulties experienced by amateur designers is that of arriving at the proper dimensions. This can readily be done by consulting the catalogue of a well known manufacturer whose figures can be relied upon.

CONNECTING BELLS.

The various methods of connecting up bells show conclusively that in many cases considerable scientific knowledge is required in order to erect an installation which will oper-

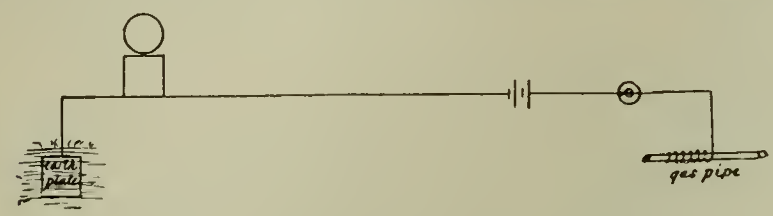


Fig 1—System With Grounded Return.

ate uninterruptedly. Generally speaking, there are two systems employed, namely, one in which the return wire is

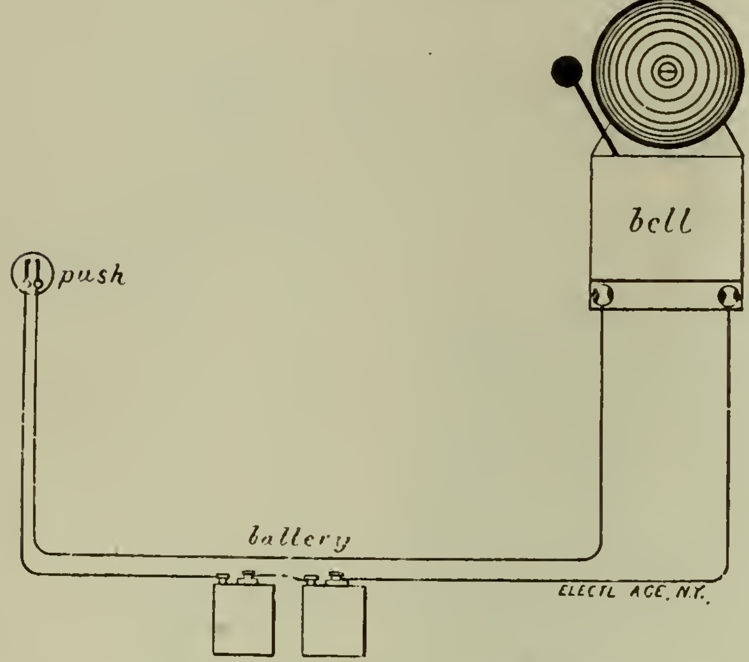


Fig. 2—Bell Wired, With Complete Magnetic Circuit.

grounded, the other consisting of a complete metallic circuit. A further subdivision can be made covering those

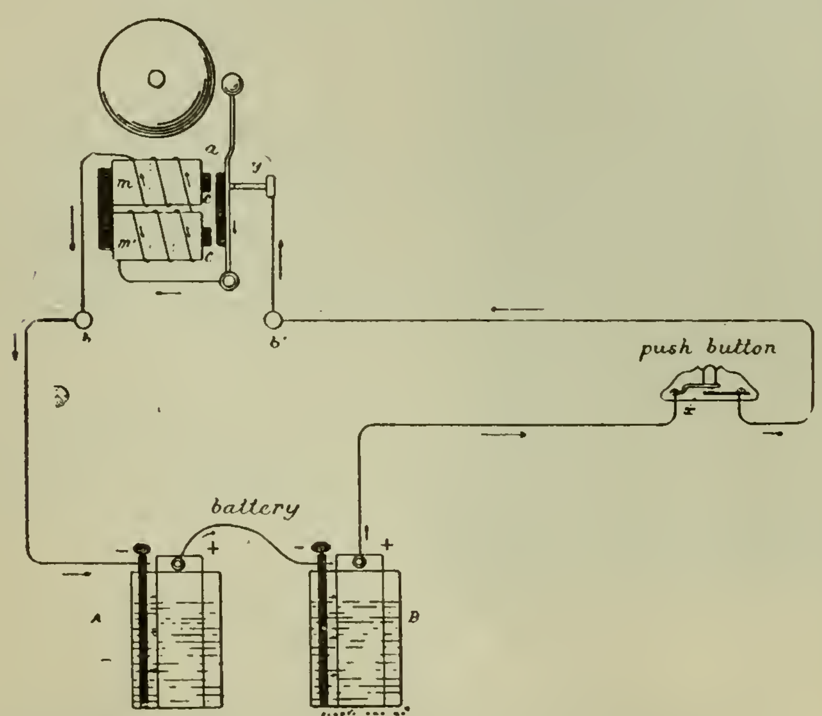


Fig. 6—Complete Circuit, Showing Connections in Detail.

cases in which bells are connected in multiple or in series. Various methods are illustrated by diagrams in this article; the first being that of a system with a grounded return; the second showing a bell wired with a complete magnetic circuit. Methods of connecting bells in multiple and series

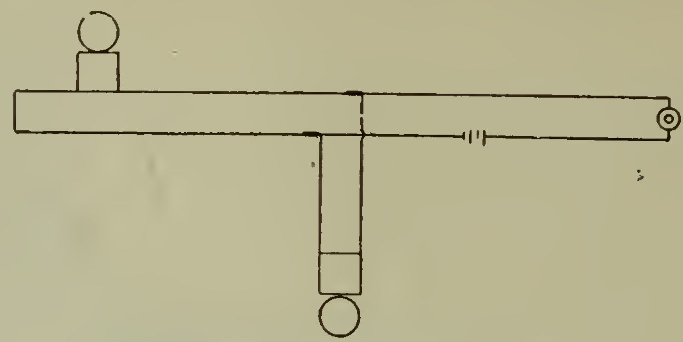


Fig. 3—Bells Connected in Parallel.

are also illustrated in sketch 3 and 4. In figure 4 the pressing of a button sets into action three bells which may be widely separated, as in the case of a fire alarm system. In

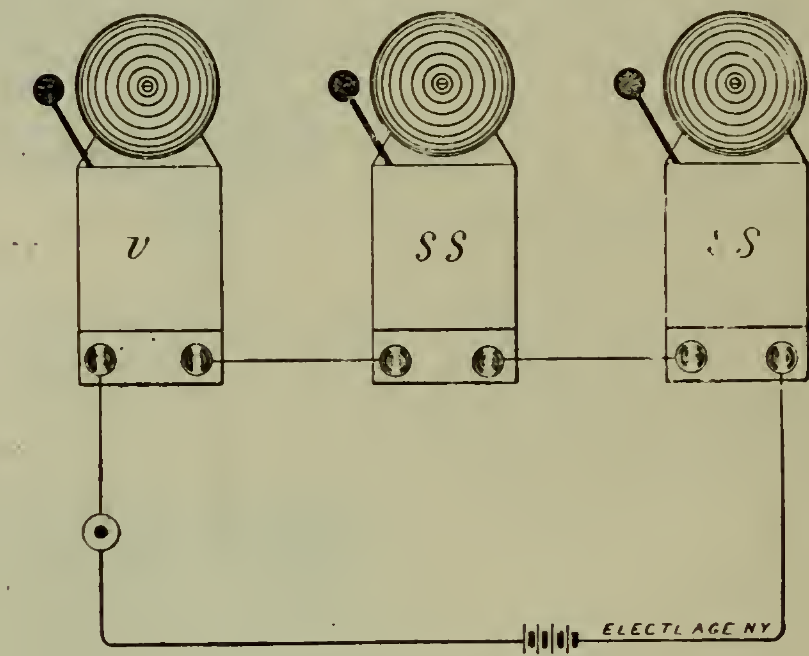
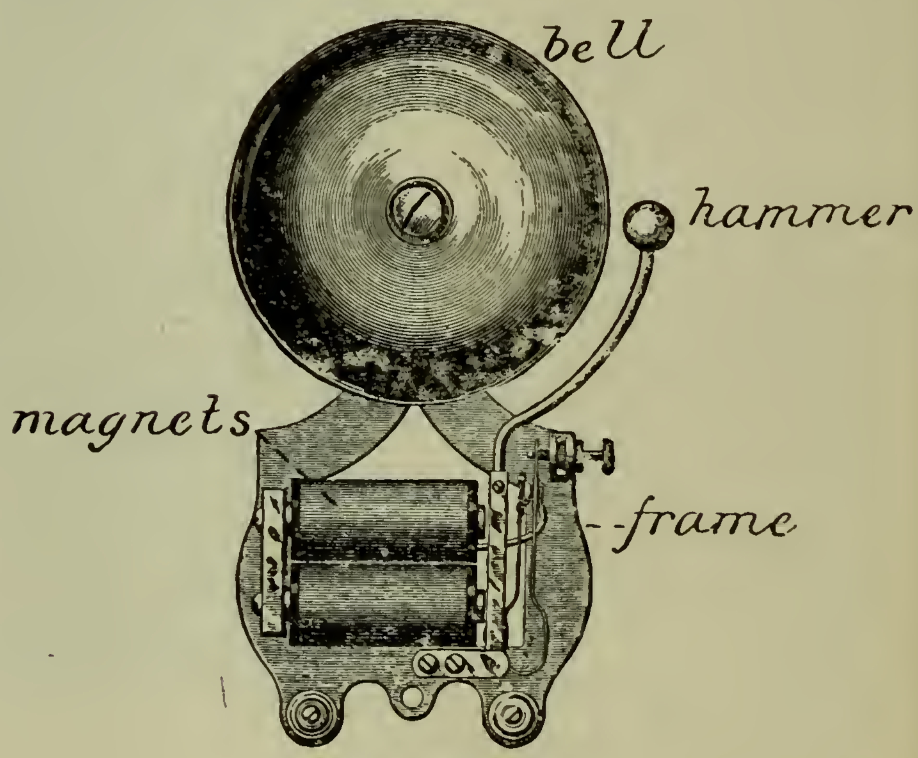


Fig. 4—Bells Connected in Series.

either case the pressing of the button sets two or more bells into action. The various parts of a bell are clearly shown in figure 5 and the connections in detail in figure A and B are cells in series, X is the make and break, MM the bell magnets, etc.

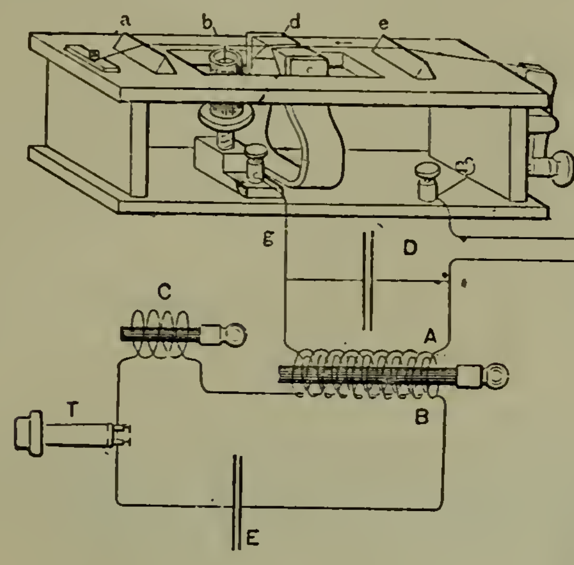


Details of Electric Bell.

HIGH FREQUENCY CURRENTS.

Prof. Pupin, of Columbia University, conducted a series of experiments with high frequency currents and invented a device for producing them. The general features of this

apparatus are shown in the illustration where A, B, D, E indicate a wire tightly stretched between the poles a permanent magnet D. A short connecting piece dips from this wire at B into a cup of mercury. When current is sent into the wire from the battery F it vibrates rapidly, in fact, sufficiently fast to produce a loud hum in the telephone T. The tension on the wire determines its rate of vibration and consequently the number of makes and breaks per second. A tuning fork, the number of whose vibrations are known, is compared with the telephone and the rate of interruption ascertained. This original and exceedingly ingenious machine has been in use by Prof. Pupin when conducting many important experiments.



Pupin's Apparatus for Producing Interrupted Currents.

POWER TRANSMISSION.

TRANSMISSION OF ELECTRICAL ENERGY IN CANADA.

As showing what is being done in other places in the way of electrical power transmission, it is noteworthy that the town of Orillia, Ont., has recently let a contract for the development of a water power 19 miles from the town, and the transmission of this power to the town for electric light and power purposes. The entire contract was let to the Central Construction Co. of Buffalo, and Westinghouse apparatus will be used throughout. It will consist of 300 K. W. revolving field generators, transformers stepping up to line voltage of 2,000 volts, and several of the Tesla type C motors. Probably about half the capacity of the plant will be used for driving motors in the different manufacturing establishments at Orillia.—Ex.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

ELECTRICAL EXPORTS FOR WEEK ENDING MARCH 21, 1899. $84,235.

New York, N. Y., March 21, 1899. The following exports of electrical material are from the port of New York for the week ending this date:

Antwerp.—55 cases electrical machinery, $4,279. 28 packages electrical machinery, $2,560.

Amsterdam.—9 packages electrical material, $3,268.

British Australia.—146 packages electrical material, $12,068; 46 packages electrical machinery, $1,473; 1 case electros, $17; 688 packages carriage material, $8,966.

British Possessions in Africa.—112 packages electrical material, $10,793.

Brazil.—22 cases electrical material, $1,195.

Bremen.—1 case electrical machinery, $115; 22 cases electrical material, $3,194.

Barcelona.—2 cases electrical material, $50.

Cuba.—104 cases electrical material, $2,359.

Christiania.—2 cases electros, $17.

Genoa.—1 case electrical material, $50.

Glasgow.—4 cases electro-plates, $460; 14 cases electrical material, $110.

Havre.—77 packages electrical material, $2,161; 90 packages electrical material, $5,889; 1 case electros, $15; 3 cases electro-plates, $385.

Liverpool.—162 packages electrical material, $8,827; 20 packages electrical machinery, $266.

London.—574 cases electrical material, $11,316.

Leghorn.—2 cases electrical material, $50.

Mexico.—106 cases electrical material, $1,270.

Marseilles.—9 cases electrical material, $854.

Newfoundland.—7 cases electrical material, $60.

Porto Rico.—108 packages electrical material, $145.

Preston.—12 packages electrical material, $1,159.

Rotterdam.—1 case electros, $10; 2 packages electrical machinery, $60.

Rome.—6 cases electrical material, $374.

Santo Domingo.—28 packages electrical material, $198.

U. S. of Colombia.—1 case electrical material, $227.

NEW INCORPORATIONS.

San Francisco, Cal.—El Dorado Power Co. has been incorporated by W. A. Bell, T. Clark, C. O. Richards, G. Lambert, H. O. Marvin; for the purpose of furnishing electrical power. Capital stock $150,000.

Trenton, N. J.—Columbia Automobile Co. has been incorporated by Elliott Mason, Andrew H. Scoble, John M. Scoble, Louis R. Moore and others; to manufacture and operate vehicles propelled by electricity, compressed air and other power. Capital stock $3,000,000.

Chicago, Ill.—Martin J. Insull Co. has been incorporated by A. H. Reece, G. C. Johnson and Robert L. Elliott; electrical machinery, etc. Capital stock $6,000.

Pittsburg, Pa.—Faraday Carbon Co. has been incorporated by Daniel D. Dickey, James S. Humbird, John S. Crider, H. Lawrence and James Parmalee; carbons for electric light and other articles for the production of electricity. Capital stock $1,000.

Trenton, N. J.—The New England Electric Vehicle and Transportation Co. has been incorporated by James E. Hayes, Arthur Phillips and Augustus Treadwell, Jr. Capital stock $25,000,000.

Malone, N. Y.—High Falls Electric Co. has been incorporated by Joseph T. Wright, Frederick D. Kilburn, J. Henry Abbott and Morton P. Abbott; to produce electricity for public and private purposes. Capital stock $20,000.

Carbondale, Pa.—Lackawanna Valley Electric Light & Power Supply Co., incorporated by T. L. Newell, J. L. Russell, G. W. Reynolds, W. D. Boyer and Grant Pelton; light, heat, power to the public in Carbondale. Capital stock $200,000.

Garner, Iowa.—Garner Electric Light, Power & Telephone Co., incorporated by E. C. Abbey, Isaac Sweigard, J. N. Sprole and others. Capital stock $10,000.

Baltimore, Md.—The Baltimore Electric Regulator Co., incorporated with a capital stock of $100,000, to manufacture electric current regulators, and other electrical specialties, etc.

Muscatine, Iowa.—The Muscatine Electric Light and Power Co., plant has been sold to Harry Huttg.

Trenton, N. J.—The Maritime Improvement Co., incorporated by Charles H. Cramp, Gustave Lindenthal and others; to construct electric light plants, etc. Capital stock $3,000,000.

TELEPHONE CALLS.

Axtell, Kans.—The Axtell Telephone Co. has been incorporated with a capital stock of $2,500.

Cambridge, Ohio.—The Cambridge Home Telephone Co. has been incorporated with a capital stock of $15,000.

Niles, Mich.—The Central Telephone Co., of Kalamazoo, has been granted a franchise to establish a telephone exchange.

Minneapolis, Minn.—The Southern Electric Telephone Co. has been incorporated by D. N. Tallman, Charles Webster, A. C. Webster, David C. Jones and Andrew Larson. Capital stock $30,000.

Edgerton, Mo.—Platte Purchase Telephone Co., incorporated by J. F. Boydston, H. H. Boydston, Holland Boydston and others; telephone lines. Capital stock $15,000.

Lincoln, Neb.—Table Rock Telephone Co., incorporated by W. C. Fellers, C. R. Judkins, C. J. Wood. Capital stock $3,000.

McArthur, Ohio.—Chillicothe & McArthur Telephone Co., incorporated by Lewis S. Dane, Otto E. Vollenweider, Dennis Steele, Isaac M. Lantz, Henry S. Hamilton and David Will. Capital stock $15,000.

Bloomington, Ind.—The Bloomington Telephone Co. has certified to increase of capital from $10,000 to $15,000.

Wytheville, Va.—The Wytheville Telephone Co. has reorganized with Julius A. Brown, president: Frank Owens, vice-president, and L. D. Calfee, secretary.

Columbia, S. C.—The American Telephone Co. has applied for charter, with Edward J. Hall, Charles D. Cole and Edward P. Meany as incorporators. Capital stock $25,000.

Augusta, Ga.—The Augusta Telephone & Electric Co. has increased its capital stock, and will improve its plant and extend its lines.

POSSIBLE INSTALLATIONS.

Jonesboro, Tenn.—The mayor may give information concerning electric light plant.

Forsyth, Ga.—T. J. Hardin, mayor, may give information concerning proposed electric light plant.

Avondale, Ala.—The mayor may be addressed concerning proposed electric light plant.

Linneus, Mo.—An electric light plant will be erected.

STREET RAILWAY NEWS.

Jersey City, N. J.—McElroy-Grunow Electric Railway system incorporated by G. De Festetics, Peter Whitney, Ferd Von Kusserow; electric railway system. Capital stock $450,000.

JOTTINGS.

SMITH & HEMENWAY CO., of 20 Warren street, the well known agents for the Ericsson Swedish telephones, have recently purchased the hardware branch of the Maltby, Henley Company, also of 20 Warren street. This move shows great progress on the part of the Smith & Hemenway Co., they being only a young concern.

MR. EDWARD LLOYD COOLEY, formerly of Boston, who has for a number of years been associated with the General Electric Company in Philadelphia, has accepted the appointment of general manager in the New England States for the C. & C. Electric Company, with his office in Boston.

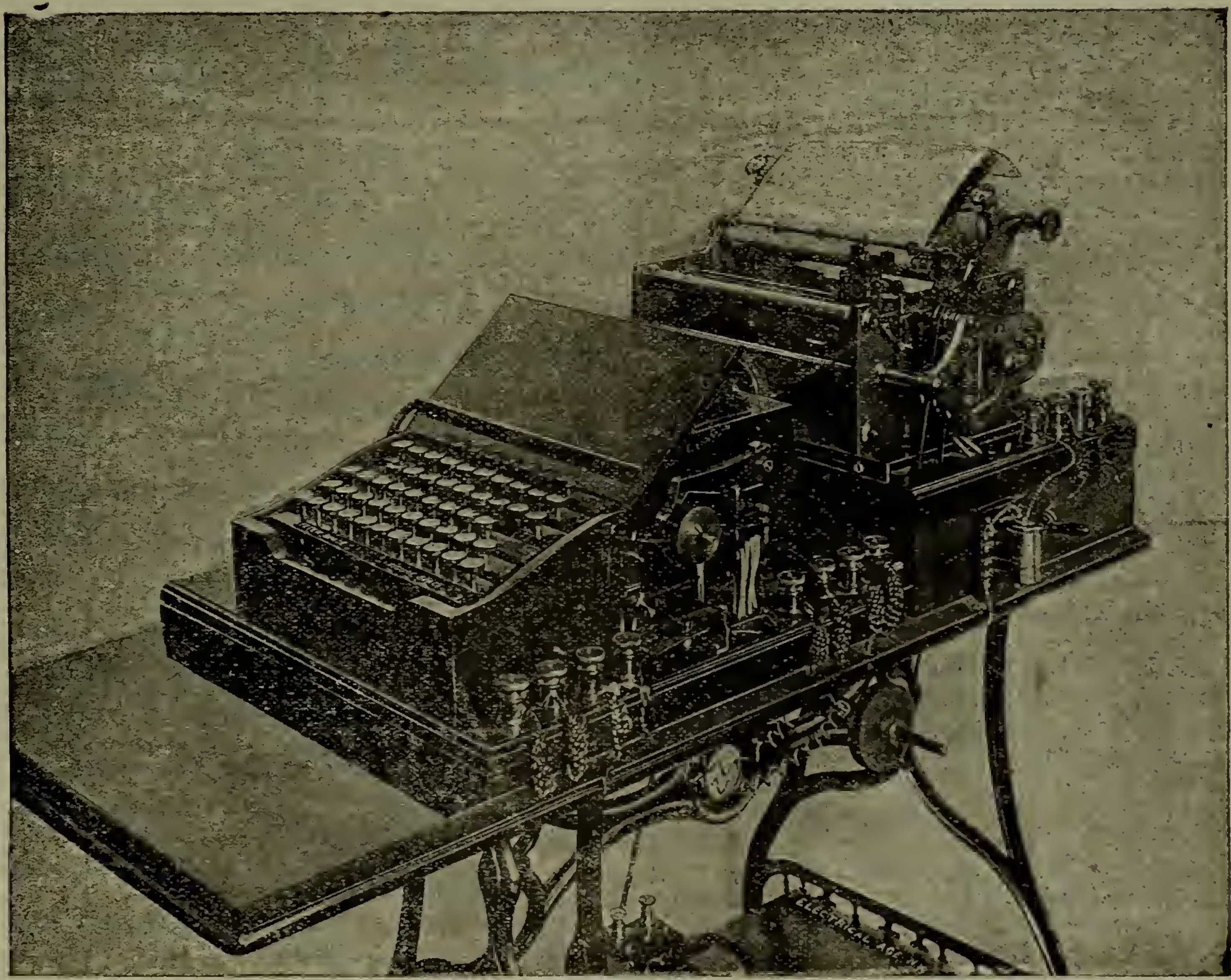
C. S. KNIGHT, former vice-president of the Fort Wayne Electric Corporation, has been elected vice-president of the Siemens & Halske Electric Company of America, with offices at Chicago.

THE MANY FRIENDS of Mr. Robert Stewart, superintendent of telegraph of the Central Railroad of New Jersey, and district superintendent of the Western Union Telegraph Co., will be pleased to learn that he is rapidly convalescing from the effects of a severe attack of pneumonia from which he has been suffering for the past month. He left Jersey City via Pennsylvania Railroad Monday afternoon, March 27th, for Asheville, N. C., to rest and recuperate. He was accompanied by the genial C. H. Lyons, manager of the information bureau of the Central Railroad of New Jersey.

The Electrical Age.

Vol. XXIII—No. 14 NEW YORK, APRIL 8, 1899. Whole No. 621

THE TELEGRAPH.



The Typewriter in Telegraphy.

TYPEWRITING BY WIRE.

Many efforts have been made by inventors of telegraph apparatus to so improve the present system that letters will be reproduced at the other end of the line instead of symbols, such as clicks or dashes. In one of our contemporaries we find that a machine for typewriting by wire has been so far perfected that it represents the subject for considerable discussion.

The invention is the work of John S. Thompson, of Chicago, and by its means "a typewriting machine may be operated in one place and a duplicate of the written material may be produced hundreds of miles away. Instead of sending written messages spelt by the Morse alphabet and then translated by the receiving operator this new method will require that the message be written upon the typewriter and by an electric circuit connected by switch with the machine the message will be automatically printed."

Mr. Thompson's invention will render the possibility of operating linotype machines, such as are used in printing offices, of active service in preparing messages hot from the wire without an intermediate process being required. This will permit press dispatches to be set and cast in lines of type ready for insertion in printing presses.

"Still another use for this invention is in connection with party line telephone systems. At present if one subscriber to a private circuit is rung up from the central station the others along that circuit are also disturbed, but by Mr. Thompson's invention this difficulty is largely overcome."

There exists no doubt in the minds of financiers and

inventors that telegraphic communication should be so far improved that readable matter is transmitted instead of signals which leave no record behind. It is a serious undertaking to disturb a well established system, but the tremendous advantages accruing from such an innovation are indisputable.

PRINTING TELEGRAPH.

A statement has been issued, says the Railroad Press, giving some of the important features of the multiplex printing-telegraph invented by Prof. Henry A. Rowland, and recently tested on the wires of the Pennsylvania Railroad, between Jersey City and Philadelphia. The invention consists of an apparatus capable of sending and receiving eight different messages, either in the same or opposite directions. The transmission is effected by an operator using an ordinary typewriter keyboard, and the receiving apparatus prints the message on a tape or sheet of paper, in Roman characters. An alternating current is used on the line, and a single letter is sent at a time, the sending machines picking out the letters in the proper order if the signals are given simultaneously. The printing instruments are operated by a direct current, but must be run perfectly synchronously, which is accomplished in a manner similar to the control of an alternating current motor by the generator. The important part of the apparatus is the alternator, run at a certain fixed rate of speed, and having on its axis an armature, with alternate plus and minus segments. These segments are connected in pairs with the keys of the typewriter, there being two segments for each letter or character. A letter can be struck at each revolution of the armature on each of the four typewriters at the sending end of the line. The impulses thus transmitted act on segments of the receiving armature, and by a local circuit print the corresponding letter. The full description of the apparatus has not as yet been given by the inventor, but it is said that it has appealed most strongly to a company of Baltimore capitalists, and that the new instruments will soon be put into extensive use.

ELECTRIC RAILWAYS.

A GERMAN ELECTRIC RAILROAD SYSTEM.

United States Consul W. K. Anderson at Hanover, Germany, says that the electric street railway of Hanover was built under the supervision and direction of an American from Philadelphia, and was opened for business on May 1st, 1892. It was one of the first electric lines inaugurated in Germany, and is now one of the best systems. The cars are modeled after American ones, and the tracks are of heavy steel, laid on a substantial foundation of concrete. The fare for a course of, say, 2 miles within the city limits is 10 pfennigs, or less than 2 1-2 cents of our money. Universal transfers are granted. The speed is about 8 miles an hour, and the cars run smoothly and with little noise. Within the mile circuit and upon some of the principal streets extending to the city limits, the cars are run on the accumulator system; but when the outskirts are reached the accumulators are released from service and the cars are run by overhead trolley. The lines extend, on almost every road, miles into the surrounding country. The trackage of the Hanover Electric Railway now amounts to over 105 miles. The equipment consists of 41 overhead-trolley cars, 161 accumulators and trolley cars combined, 167 trailers, 20 locomotives, 4 sprinklers and 24 freight cars. There are six power stations, four of which furnish, in addition to power for the cars, electric light for streets and roads. The motor cars are 17 to 34 H. P., and the locomotives 50 H. P. each.—Ex.

ELECTRIC TRAMWAY.

A novel style of tramcar has been introduced at Dresden. It is designed by Max Schiemann and built by Robert Leibscher, both of that town, and if we may rely upon the illustration in the "Schweizerische Bauzeitung," it is of pleasing appearance. Practically, we may say that two four-wheeled cars have been joined together, forming a central platform between the two, from which alone the car is accessible. In the central compartment the guard takes his stand. The driver rules in front. It is evident that such a long car is comparatively cheaper than two cars of the same capacity, and with its two bogies, at the same time not so unwieldy as one long car. The roof of the central part is formed by projections from the roofs of both cars. We presume that the cars are always to run in the same direction, for there is only one stand for the driver, one pair of wheel guards, and the central platform can be entered only on one side. On a ring line the advantages of these double cars would come out more fully.—Ex.

EXPERIMENTAL SCIENCE.

THE NERNST LAMP.

The electric lamp recently invented by Nernst, as has been stated in this journal, consists of a small rod of magnesia which is heated to brilliant incandescence by an electric current which is pushed through it by an electromotive force of several hundreds of volts. The rod must be heated nearly to a red heat by a blow-pipe or other independent means before it passes sufficient current to operate.

A number of these lamps have been made in the Physical Laboratory at Bethlehem, Pa. It has been found that a rod of pure magnesia can scarcely be started even with 1,000 volts and a good blow-pipe. The surrounding air becomes electrically too weak to withstand the high electromotive force at a temperature lower than that required to make the rod a sufficiently good conductor. This is true even when the rod has been heated to softness beforehand in a temporary mounting.

The conductivity of the rod may be completely controlled by mixing with the magnesia varying amounts of silica and fusible silicates. A satisfactory lamp is made as follows: Pure calcined magnesia (heavy) is thoroughly mixed with two or three per cent. of powdered silica, one or two per cent. of magnesium sulphate, and one per cent. or less of sodium or potassium silicate (water glass). The mixture is dried until it is just moist enough to pack under pressure. A small piece of brass tubing is lined with a roll of several thicknesses of stiff writing paper, and the mixture is tamped into this tube. The tube is then baked until the paper is burned, when the rod of magnesia may be removed. This rod is then laid upon a bed of magnesia (powdered lime would, perhaps, answer) and by means of carbon terminals an alternating current is passed through the rod, heating it first to redness by a blow-pipe. With some care a very hard and compact rod of magnesia is thus formed which is then ground to a thin rod with large grooved ends. Platinum wire is wound on these grooved ends and, if desired, cement made of water glass and powdered magnesia may be used to cover the platinum. The two platinum wire terminals may then be bound to the sides of a small glass tube as a support. A lamp made in this way may be started easily, although its resistance rises slowly with continued use, owing, perhaps, to the volatilization of the potassium or sodium silicate. Calcium silicate would, perhaps, be more satisfactory in this respect.

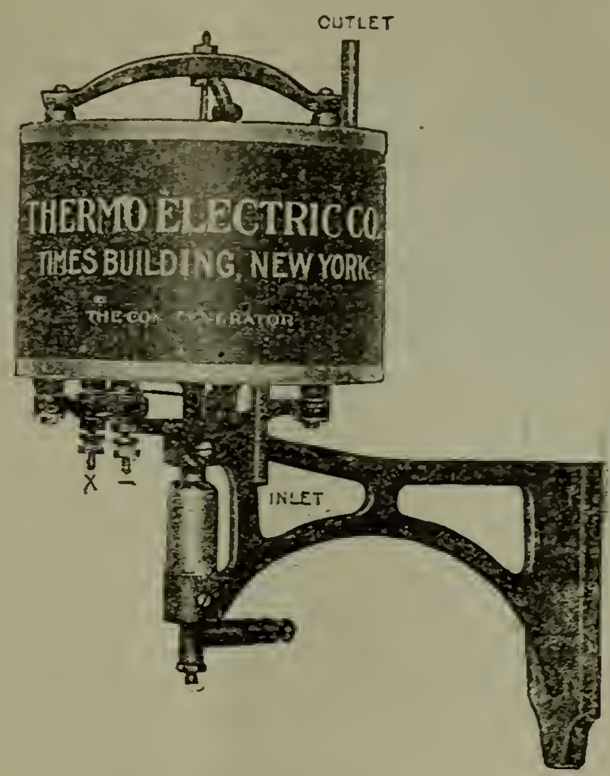
A very striking experiment may be performed with a piece of glass tubing several inches long wound with copper terminals at its ends. The tube begins to pass considerable current at a low red heat, with a few hundreds of volts, and is quickly melted by the current. A thin-walled tube half an inch or more in diameter is best, and it should be heated along one side only so that the cool portion of the tube may for a short time serve as a support for the hot conductive portion.—W. S. F. in Science.

THERMO-ELECTRICITY.

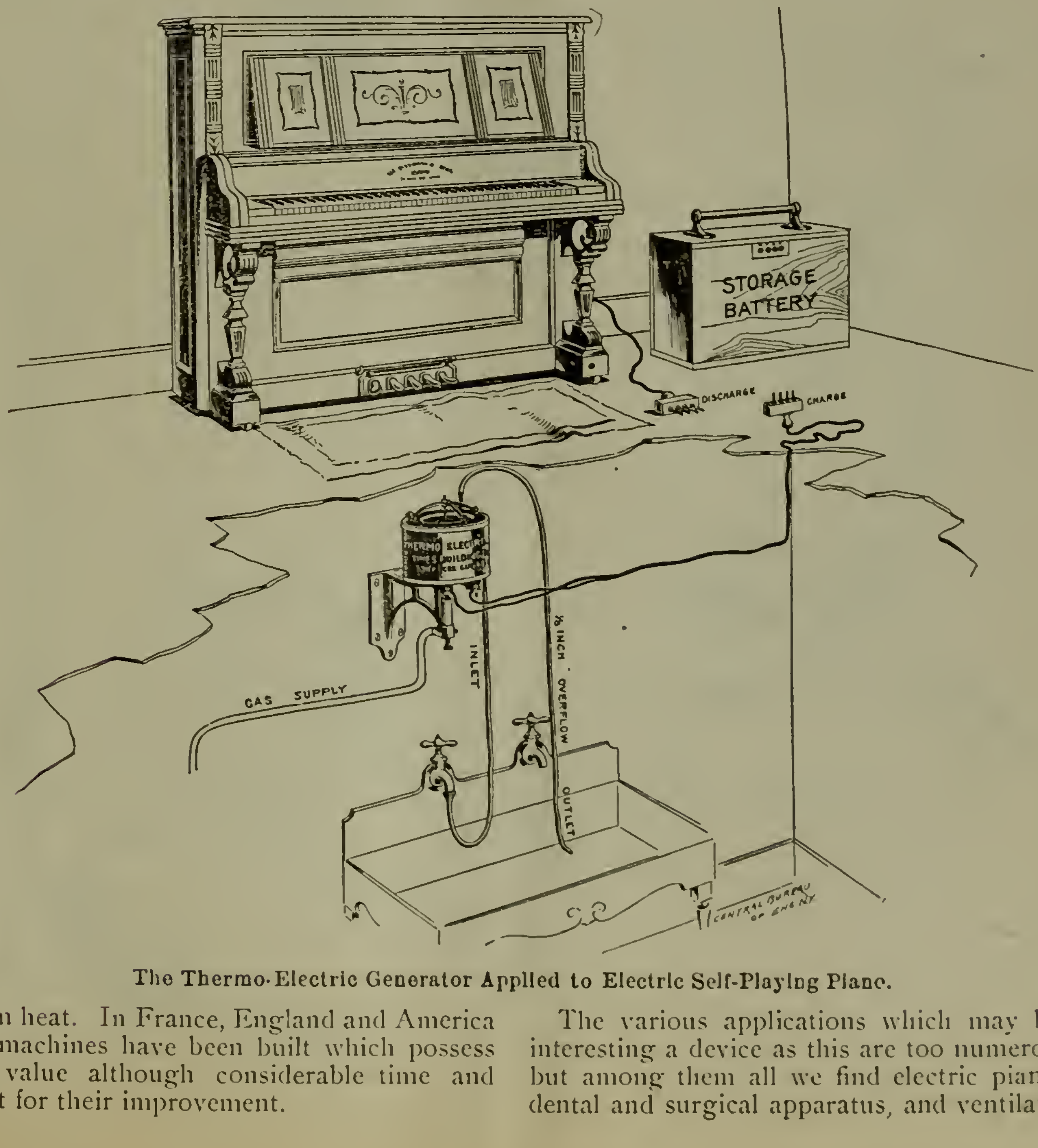
ELECTRICITY DIRECT FROM HEAT.

Electricity can now be produced direct from heat. In fact, we can turn the heat unit of a gas flame into electricity without any moving machinery being employed. The history of experimental science marks many failures on the part of investigators, desirous of producing electricity direct from heat. In France, England and America thermo-electric machines have been built which possess no commercial value although considerable time and money was spent for their improvement.

The thermo-electric generator is a device containing series of metal slips so joined and arranged that wh heat is applied to one set of junctions and cold water the other a powerful current is produced. All that is ne essary therefore is a gas flame playing upon the interio of this apparatus and water circulating around the out side, as shown in figures 1 and 2, sectionally; and as pe photograph in figure 4.



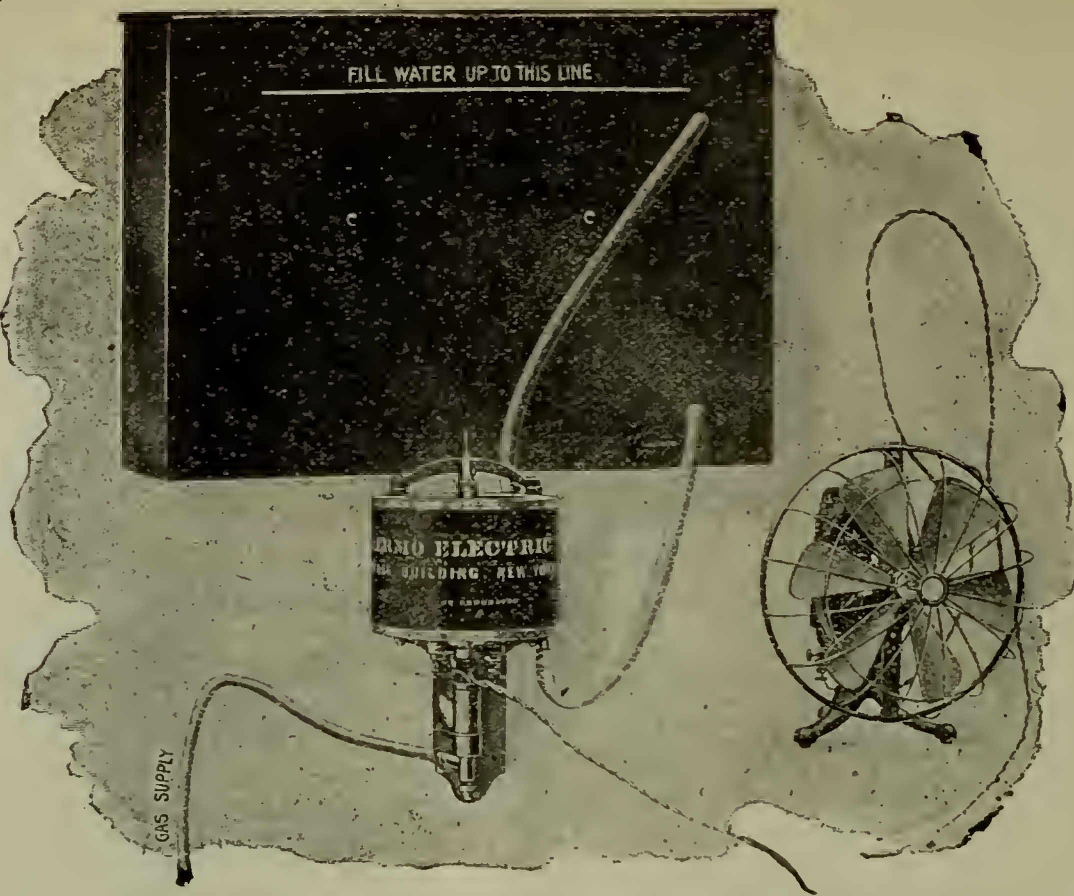
The Thermo-Electric Generator.



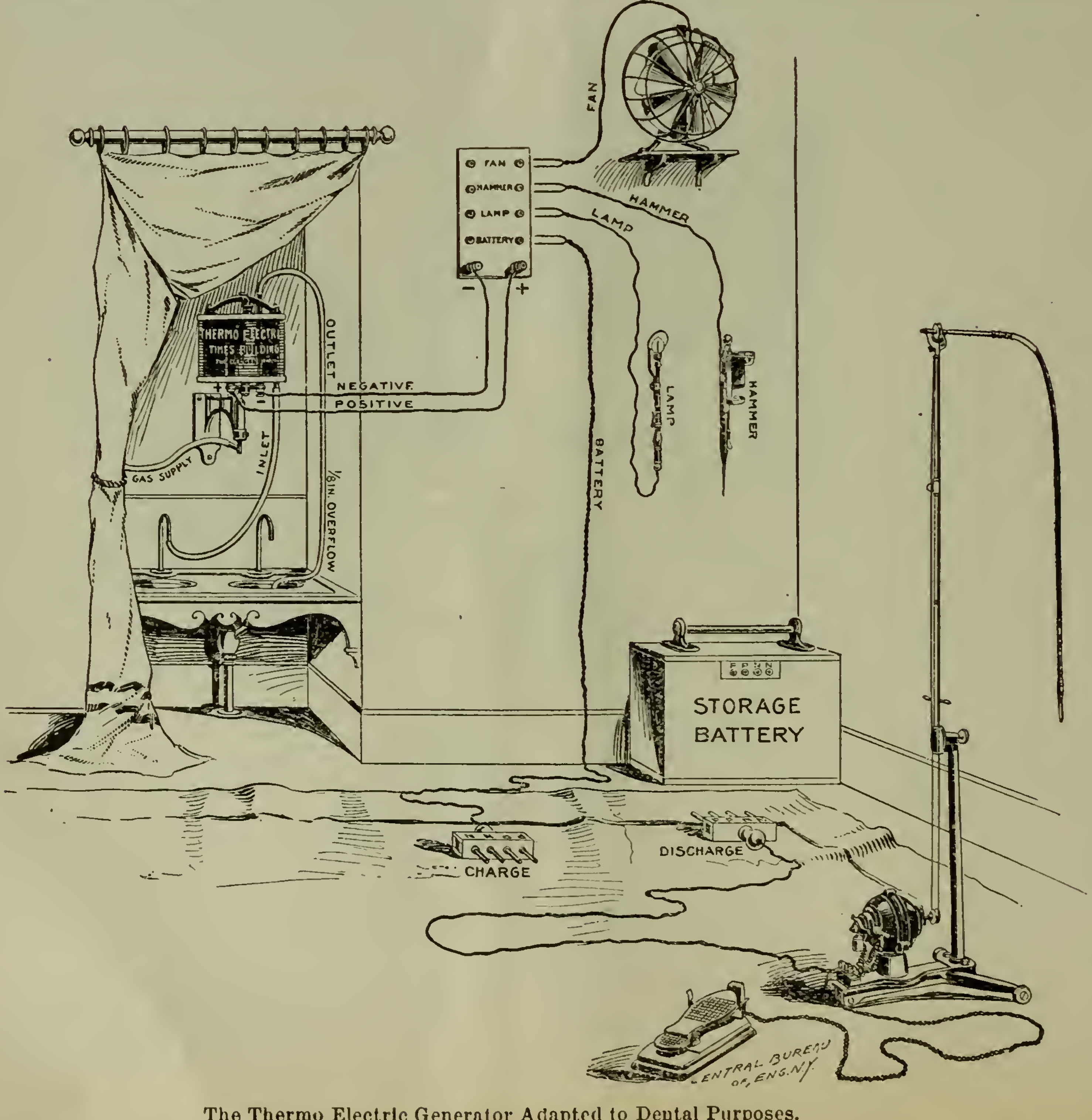
The Thermo-Electric Generator Applied to Electric Self-Playing Piano.

The various applications which may be made of so interesting a device as this are too numerous to mention, but among them all we find electric piano attachments, dental and surgical apparatus, and ventilation on a small

scale, successfully accomplished by the use of the thermo-electric generator. A reserve of power may be stored by means of an accumulator and used for the purposes de-scribed without requiring but a trifle of attention. This idea developed on a large scale would mean some re-markable changes in modern engineering. The offices of



The Thermo-Electric Generator in Position, Showing Water Tank.



The Thermo Electric Generator Adapted to Dental Purposes.

The Electrical Age.

ESTABLISHED 1883.

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NEW YORK, APRIL 8, 1899.

CONTENTS

THE TRANSMISSION OF SOUND BY LIGHT RAYS.

A series of highly interesting experiments have been made by Mr. Sella and published in the London "Electrician," for February, on the production of sound by means of ultra-violet rays. The article originally appeared in the "Nuovo Cimento," in October last.

Quoting from one of our contemporaries we read as follows: "A telephone is placed in the circuit of a strong influence machine in series with a short air gap. If a beam of ultra-violet light is directed onto the negative terminal of the gap the sound in the telephone is greatly altered. If the ultra-violet light undergoes periodical variations the sound in the telephone will vary in the same way."

The gist of this experiment is to the effect that ultra-violet rays were allowed to play upon a fluorescent screen, directly or indirectly. The variations in the brightness of the screen cause changes in the resistance of a selenium cell connected with a telephone receiver. By this means sounds are produced in the telephone corresponding, acoustically, in period and development, to the ultra-violet rays.

This experiment opens up an interesting field of thought and possible investigation. If ultra-violet rays or any other ray can be made to excite fluorescence or its equivalent on a screen of passive material telephony can be accomplished between two distant points without the need of wires. The success of such an experiment would largely depend upon the reaching power of the rays and the sensitiveness of the recording, or rather receiving, would depend upon the delicacy of the apparatus at that end.

According to Sella's experiment the telephone and a static machine are arranged in series, a short air gap interrupting the circuit. The beam of ultra-violet light is allowed to play upon the negative terminal of the gap, as described above. The telephone thereby becomes affected sufficiently to make such differences distinctly audible although they are entirely due to the changes in the ultra-violet ray.

The telephone systems of to-day are sufficiently private, as far as the receipt or sending of a message are concerned, to annihilate discussion on this score but the main difficulty is in connecting "Central" with sufficient rapidity to prevent over-excitation on the part of choleric individuals. To such as these a telephone system devoid of a mediator would certainly act as a soothing balm. It would be impossible to state, without limitation, the consequences of this discovery upon modern telephone systems but it is simple to understand how vastly more flexible a system would become if rendered independent of "Central."

A COMPARISON OF SOUND AND ETHER WAVES.

A paper was read by Mr. F. W. Branson, before the Leeds Naturalists' Club and Scientific Association in which the writer discussed varieties of waves known as Roentgen rays, photographic light, heat rays, Hertzian waves, acoustic vibrations, etc. A series of experiments were made by Mr. Branson, comparing sound waves with Hertzian waves, to illustrate the differences between such actions when occuring in the atmosphere and in the ether. Quite a few models and methods of illustration were employed and facts and figures deduced which are well worth recording in some convenient note book.

The data is as follows: Roentgen rays represent 288,224,000,000,000,000 vibrations per second in the ether. The photographic limit of the solar spectrum corresponds to 1,125,899,906,842,624 vibrations per second. Electric oscillations or Hertzian waves represent 67,108,864 vibrations per second. The highest note in music 4,096; the lowest note 32 vibrations per second.

It is highly interesting to note these differences because they place before the mind a true picture of the phenomenon of light and its degeneration, so to speak, into lesser vibrations known by different names. We can easily realize that the word light only possesses a meaning from a physiological standpoint. To eyes possessing a greater range of vision than our own magnetic lines of force might be perceived as well as Hertzian waves although appearing to such a vision as a sort of twilight or haze. Nature has limited our sight as well as our hearing and forced us to see by means of vibrations, beyond which extends a high and impenetrable wall of Stygian darkness. With our super senses and the apparatus at our disposal these other regions are made known to us but the limitations of our senses prevent us from peering into this great and unexplored region.

To the scientific mind vibrations in the ether are arranged and classified in much the same way as a zoologist would arrange the various species of animals placed before him for inspection. There are species of light rays whose properties make them absolutely distinct from all others. When a ray possessing a new rate of vibration comes within range of our investigation it always means some new and unexpected phenomenon intimately associated with it. The Roentgen ray, the Hertzian wave and the magnetic line of force are merely well known examples.

the Thermo-Electric Company are at 102 Times Building, New York.

MISCELLANEOUS.

STRAY CURRENTS.

THE VOLTA CENTENARY.

The Zurich correspondent of the London Times writes to the effect that the organization of the memorial exhibition, to be opened at Como on May 14th, and towards the cost of the buildings for which the town has voted a handsome sum of money, is proceeding rapidly. The exhibits will be almost entirely electrical. It will be remembered that Como was the birthplace of Volta, who also died there in 1827. The exhibition buildings will face Lake Como, on which a number of electric launches and boats will ply. It may be also recalled that Volta's electric pile was first described in England in a letter to Sir J. Banks, then president of the Royal Society. This letter is dated March 1, 1800, and was read before the society on June 26th the same year.—Ex.

ELECTRO-HYDRAULIC LIFT.

Hydro-electric lifts used to be more common than electro-hydraulic lifts of the type we are going to notice, in which the power is electric, but used for going up only, and the regulator hydraulic. The system is that of Guyenot and Mocomble, and it is illustrated in the "Nouvelles Annales de Construction." A continuous current motor pulls the cage up by means of the usual pulley rope; the downward motion is simply by gravity. It is manifest that this arrangement simplifies the motor construction very materially, and allows of a superior utilization of the electric power which is not drowned in regulating resistances. Both the cage doors and the floor doors close automatically, and the cage cannot start when a floor door is open, as is customary. The chief interest lies in the hydraulic arrangement. Pressure pumps and hydraulic accumulators are not needed. The piston of the cage moves in a cylinder which communicates with a water tank placed in the basement, but at higher level than the regulating mechanism. When the cage is ascending, water continues to flow into the cylinder; when it stops, the valve in the connection is closed, and the cage rests on a water cushion. The valve lever is manipulated

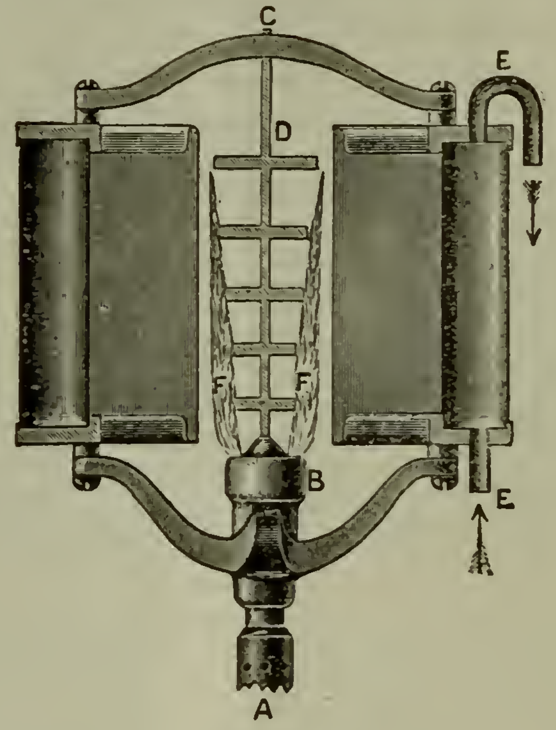


FIG. I.

Section of Thermo Electric Generator Showing Flame Burning Correctly.

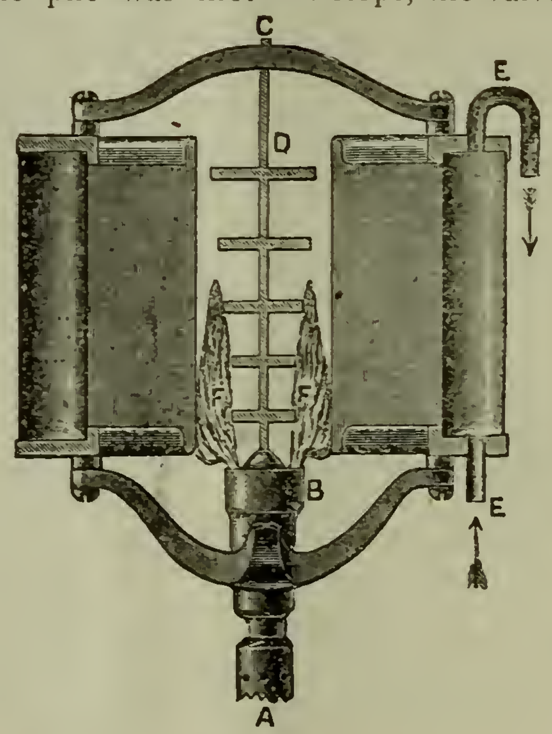
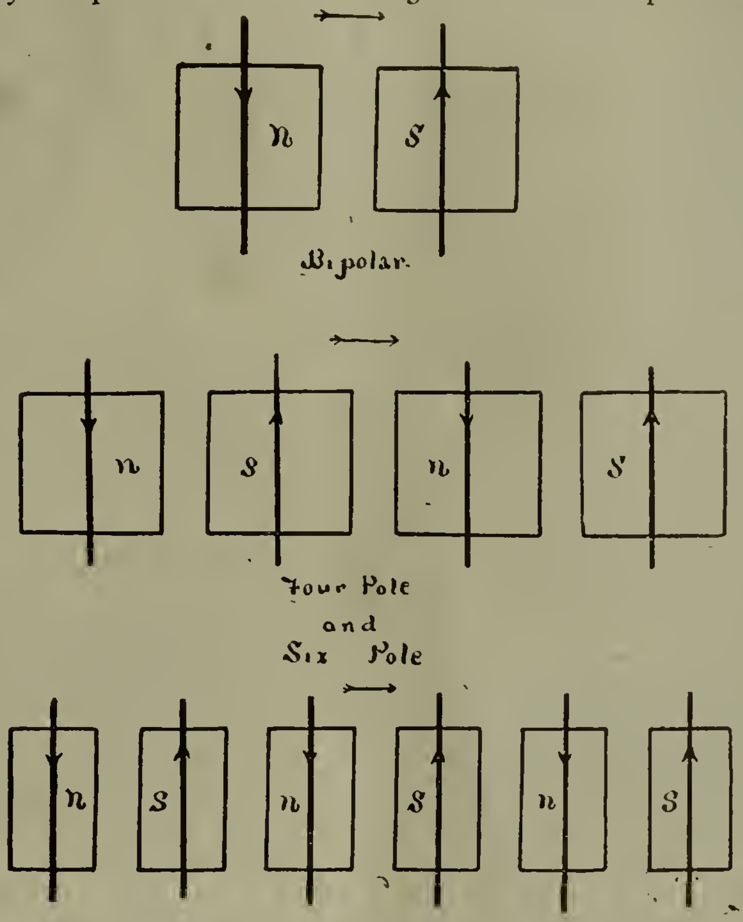


FIG. II.

Section of Thermo Electric Generator Showing Flame Burning Incorrectly.

by the guide rope by the intermediation of the guide rod and links. When the cage is at rest, the lever is inclined above the horizontal by about 20 degrees. In order to facilitate the motion and to render it gentle, a weight glides on the lever. The lever further communicates, by means of links, with the starting switch of the motor; this switch cuts out liquid resistance. Thirdly, there is inserted into this starting gear an oil cylinder, in which the oil is pressed through an orifice in the piston, upward or downward, according to the cage motion. The description may sound complicated, but the whole mechanism is, in reality, very simple.—Ex.



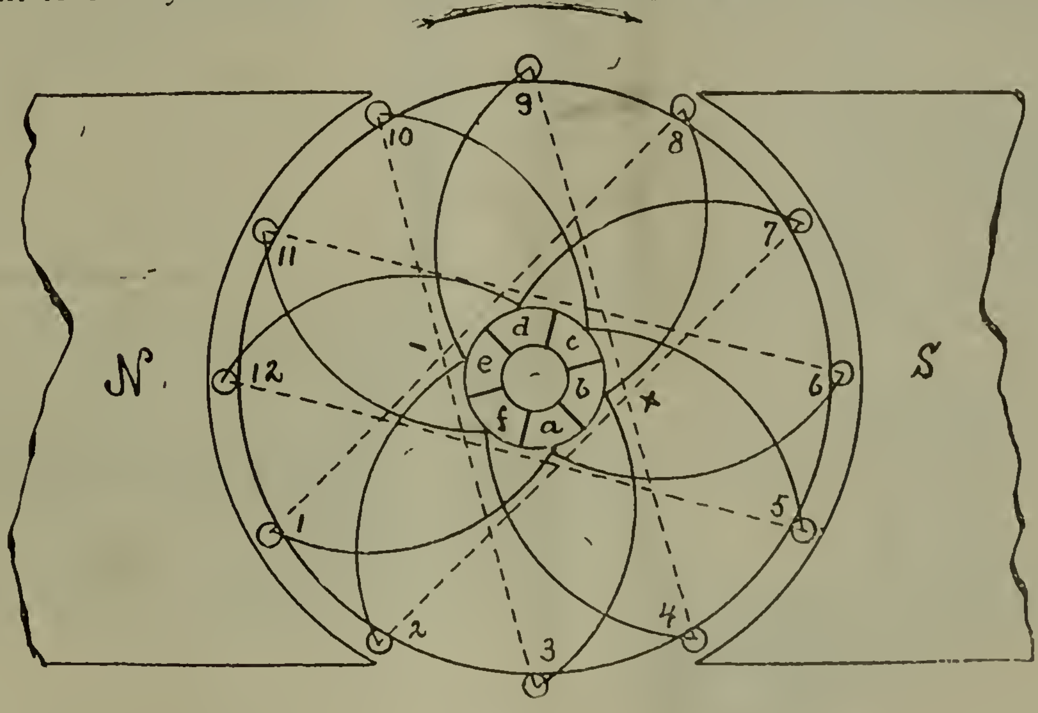
Two, Four and Six Pole Generator, Showing Direction of Inductors and Current.

TECHNICAL NOTES.

LAP AND WAVE WOUND ARMATURES.

The following illustrations refer mainly to methods of pole, four pole and six pole machine is clearly shown in sketch one. It is difficult to clearly illustrate the nature of a winding when the number of inductors becomes too great but for the benefit of our readers we show in figures 2 and 3 the winding of a twelve inductor and sixteen in-winding armatures for bi-polar and multi-polar dynamos. The direction of the current in the inductors of a two ductor drum armature. In each case lap winding is shown. The pitch in figure 2 is five; the pitch in figure 3 is likewise five. In figure 4 a lap wound drum armature of twenty conductors is shown diagramatically. The pitch in this case is nine.

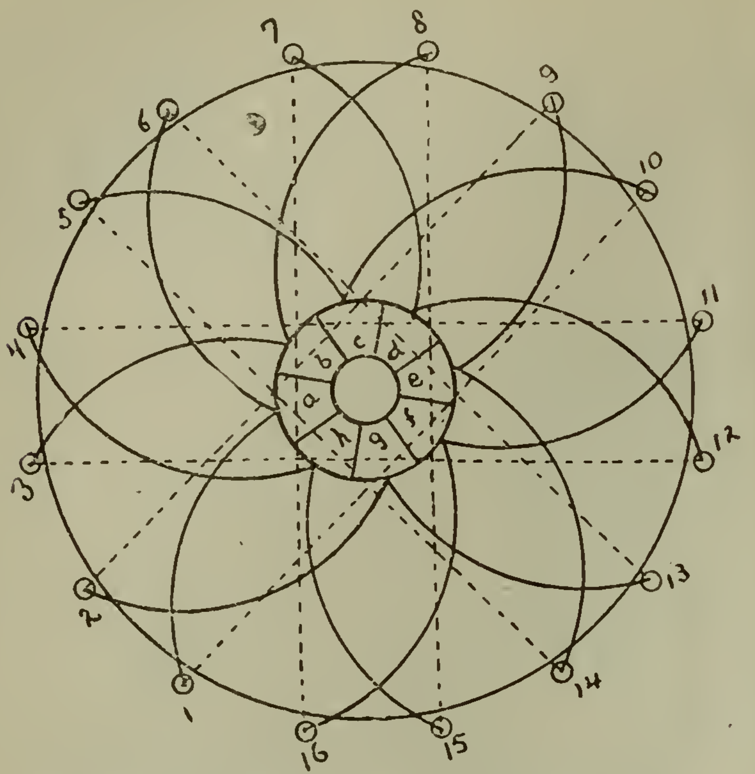
The number of commutator segments in each of the cases mentioned can be used as a divisor for the number of conductors on the armature. In figure 2 twelve inductors, six commutators segments; in figure 3 sixteen inductors, eight commutator segments; in figure 4 twenty inductors, ten commutator segments. Figures 5 and 6 show lap end wave winding of a six pole generator. If the winding is traced from the positive end of any winding in figure 5 the laps are discovered. In figure 6 a series of waves would result. The presence of three positives and three negatives in figure 5 indicates a multiple winding. The single positive and negative in figure 6 shows a series wound armature. In figure 5 a winding of this description would necessitate the use of a commutator with six brushes, each pair carrying one-third of the current. Fgure 6 shows winding for pressure, the current being one-third; the volts three time as great as in the previous figure.



Bi-Polar, Lap Wound Armature with Twelve Inductors.

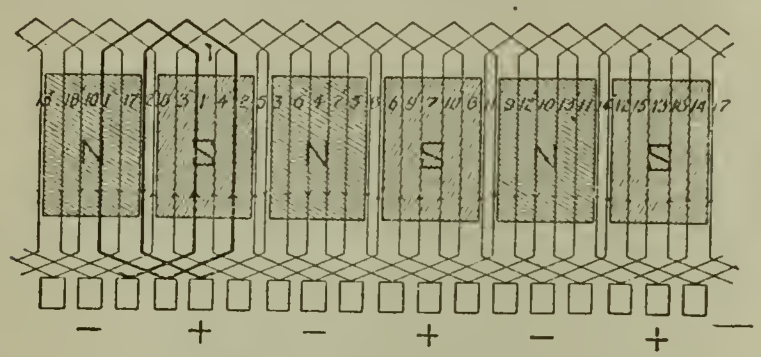
THE DISTRIBUTION OF ALTERNATING CURRENTS, OVERHEAD AND UNDERGROUND.

In small towns and villages municipal regulations are



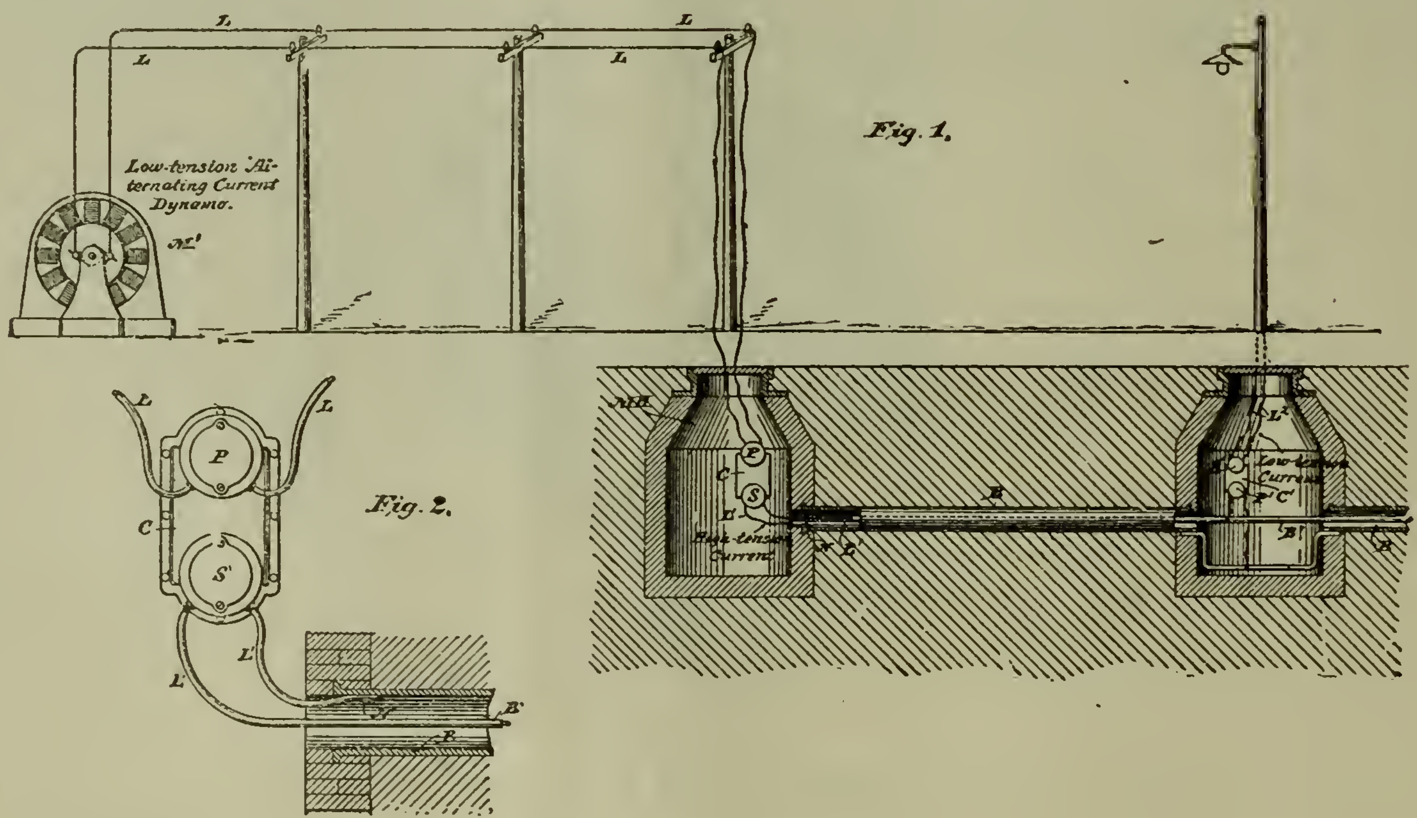
Lap Wound Armature with Sixteen Inductors.

not as severe as in more densely populated centres. Wires



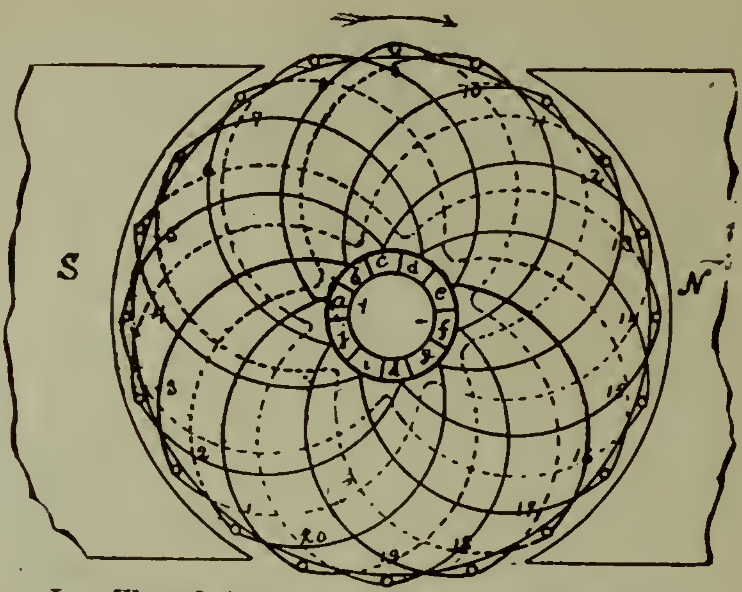
Six Pole Machine Lap Wound Armature.

are generally run overhead entirely or in exceptional cases



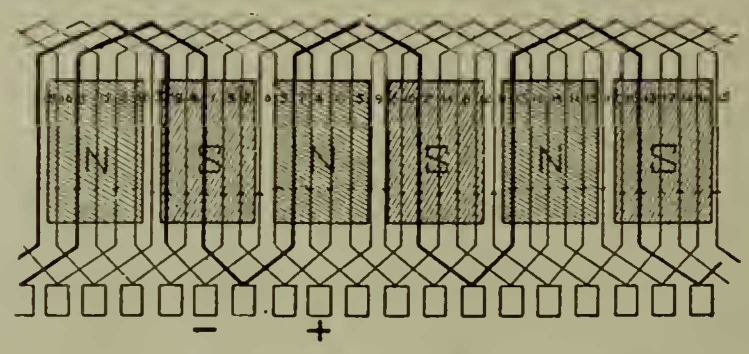
Subway and Overhead System Combined.

run through ducts, underground. In figure 1 and 2 a combination system is clearly shown. Many of the risks due to leakage or grounds are obviated by placing the conductors beneath the surface only where



Lap Wound Armature with Twenty Inductors.

the population is thickest; running the wires on poles along lonely roads or across lots. P and S represents primery and secondary of transformer; LL the line; MH the manhole, etc.

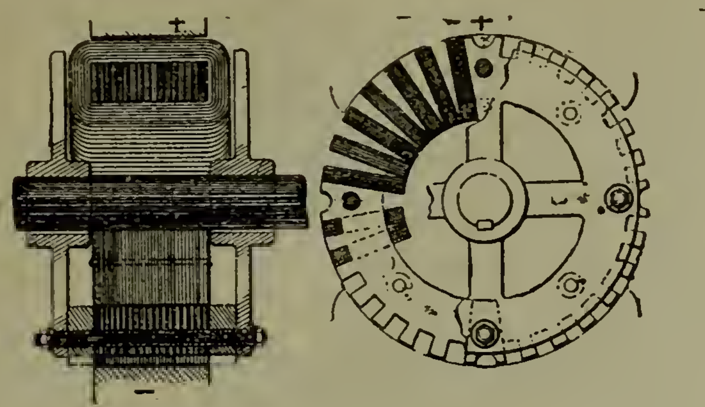


Six Pole Wave Wound Armature.

GRAMME WOUND, TOOTHED ARMATURES.

The inductors of a Gramme armature represent only half the weight of wire wound around the ring. A careful test by Carl Hering showed conclusively that the inner conductors were dead, being shielded from the influence of the

lines of force by the iron core. In order to reduce the proportions existing between active wire and dead wire the peculiar type of disk armature has been evolved. If it were not for certain difficulties in construction it would probably be more largelyl used than it is. Weight for weight, includ-

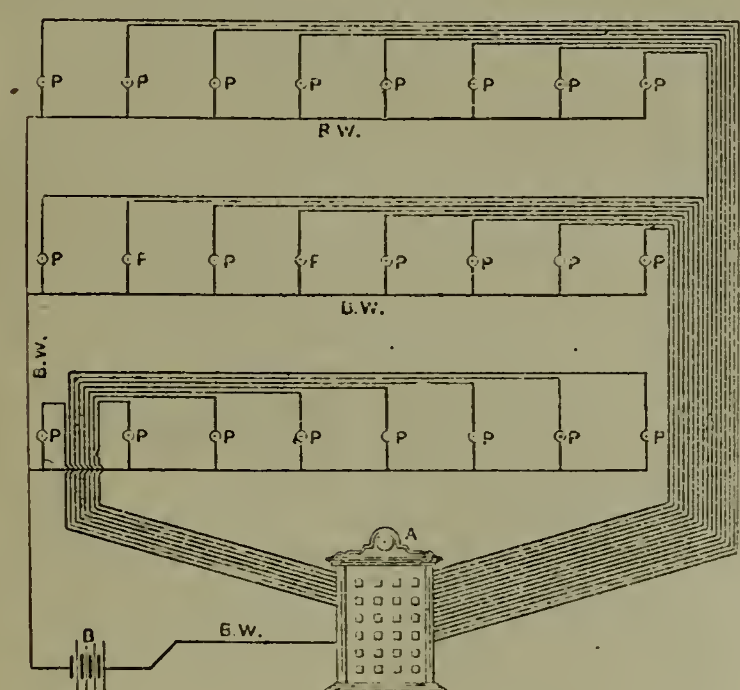


Gramme Wound Toothed Armature.

ing both copper and iron, a disk armature has a greater output than either drum or ring. The ring, however, is generally employed on account of its convenient construction and moderate diameter.

ELEVATOR BELL WIRING.

In the illustration the connections are shown for bells

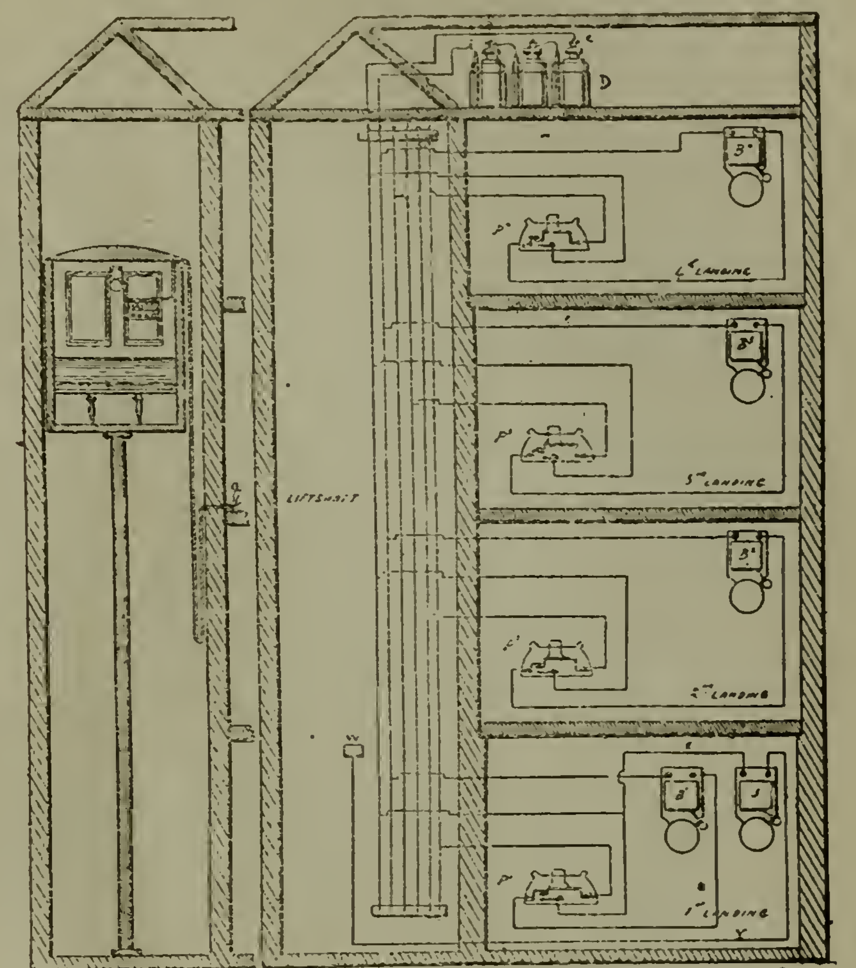


Annunciator Connections, Three Floors.

on various floors which operate the annunciator in the

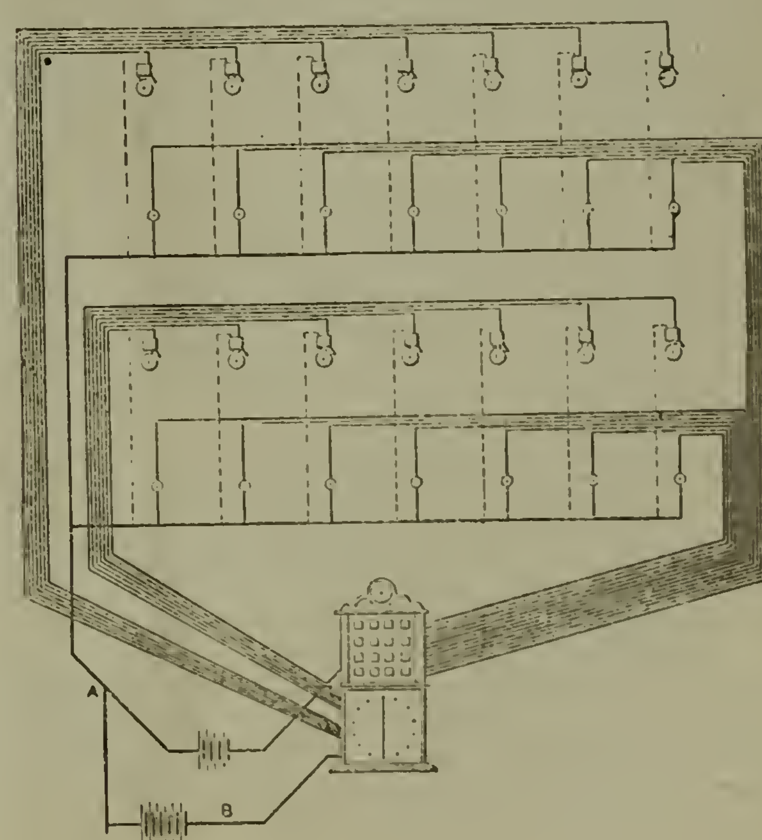
Annunciator Connected to Private Houses.

moving elevator. The connections are shown in detail on the right with batteries, push and bell, as connected in practice. The sketch closely adjacent on the left shows the cable, after all connections have been made, attached to the elevator car and running to the annunciator. The annunciator system of a private house and a hotel with



Annunciator Connections, Bell and Push for Elevator.

connections worked out in detail is also shown in diagrams B, C and D. The conductors gradually accumulate on the return side but the leading principle is very simple. A common feed wire runs to all the push buttons; all of



Annunciator Connections, Bell and Button.

the returns are bunched together, as shown in figures C and D, where the main body of wires come in on the right.

ELECTRIC LIGHT AND POWER.

ELECTRIC LIGHT IN THE VATICAN.

Cosmos gives in a recent issue somewhat full details of the electrical installation which has recently been put down in the Vatican. It seems that the Popes of Rome have hitherto employed entirely either candles or oil lamps, and that the present Pope is responsible for the radical change now established. The machinery supplying the light consists of a turbine of 10 horse-power and a gas engine of 20 horse-power. The turbine is driven from the fall L'Aigle. As a set of accumulators are being used the water will only be taken at night-time, so that the waterfall will not be disfigured during the day. The turbine drives the dynamo, giving 60 amperes at 180 volts at 1,000 revolutions, while the gas-engine drives the four-pole machine, giving 130 amperes at the same pressure. As only 58 cells of accumulators are being used, we presume that 110 volts will be the likely pressure. The article goes on to describe the religious ornaments consisting of statues, etc., which have been placed in the engine-room, and which it considers both artistic and pious. As the Pope remarked, according to a Reuter's telegram, "people will no longer be able henceforth to reproach the Vatican with being the enemy of light."—Ex.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., has been awarded a contract for the electrical equipment of fourteen cars for use in the city of Cairo, Egypt.

LITERARY.

"SARATOGA THE BEAUTIFUL."

We are in receipt of an advance copy of the N. Y Central and H. R. R. R.'s "Four-Track Series" No. 22, entitled, "Saratoga the Beautiful."

This booklet is the newest and latest addition to its already large list of books of travel and will be found both entertaining and valuable to those interested in this peerless American resort. The letter press is very interesting and covers, in addition to historical sketches, brief descriptions of the diversified attractions and amusements in and about Saratoga.

It is richly embellished with no less than seventy-five new and original half-tone illustrations of great beauty and attractiveness, including a number of views of the new "Saratoga Limited" train which the New York Central will place in service between New York and Saratoga early in July, together with a relief map of the route of this train and a new general map in several colors of the territory covered by the New York Central lines.

Nothing of such comprehensive character and exquisite beauty was ever before attempted in relation to Saratoga, and it may indeed be considered a gem in summer resort literature. A copy of the booklet will be sent free, postpaid to any address upon receipt of two 2-cent stamps.

The "Saratoga Limited," the train referred to in the book, and upon which it is mainly founded, is being built at the Wagner shops at Buffalo. It will be one of the handsomest trains in the world, and will be run on the speed of the Empire State Express, taking only three hours and a half between New York and Saratoga; the ordinary time being about five hours.

The importance of the train to the travel between New York and Saratoga will no doubt be deeply appreciated by the public.

AMONG THE SOCIETIES

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 133rd meeting of the Institute was held at 12 W. 31st street, Wednesday evening, March 22, President Kennelly in the chair. A paper was presented by Dr. M. I. Pupin of Columbia University on "Propagation of Long Electrical Waves." The paper was discussed by Messrs. Bradley, Carty, Kennelly and Steinmetz. At the meeting of council in the afternoon the following associate members were elected:

Tom Howard Gregg, New Brighton, S. I.; Harold J. Horn, 36 W. State street, Trenton, N. J.; Howard S. Johnson, 76 Jefferson avenue, Columbus, O.; Herbert S. Miller, 1025 W. Jersey street, Elizabeth, N. J.; William D. Pomeroy, 1106 South Main street, Akron, O.; Thos. Byrd Whitted, 211 State street, Schenectady, N. Y. The returns from the nomination blanks sent in by the membership committee were canvassed and the following were announced as the council nominees: For President, Dr. Arthur E. Kennelly; Vice-Presidents, J. W. Lieb, Jr., Charles F. Scott, L. B. Stillwell; Managers, C. O. Mailloux, S. Dana Greene, C. S. Bradley, W. D. Weaver; Secretary, Ralph W. Pope; Treasurer, George A. Hamilton. The council appointed Dr. F. A. C. Perrine to fill out the unexpired term of Mr. W. F. C. Hasson, who has resigned from the office of manager on account of his removal to the Hawaiian Islands. The regular election will proceed after the distribution of the ballots early in April, and the result will be determined at the annual business meeting which will be held in New York City, Friday, May 16th, 1899. The council decided to hold the fifteenth general meeting at Boston during the last half of June, the exact date to be fixed by the executive committee.

The following local honorary secretaries have been appointed.—H. F. Parshall, London, for Great Britain; Jam S. Fitzmaurice, Sydney, for Australia; Prof. Robert Owens, Montreal, for Canada.

NEW YORK ELECTRICAL SOCIETY.

The following members were elected at the last meeting of the New York Electrical Society, March 29th:

Theodore Beran, F. C. Bates, R. H. Proctor, Philip R. Backus, Edward L. Reynolds, Harcourt Lee, R. R. Reed, S. L. Nicholson, Henry O. Pond, I. Walter Ullman, Jefferson Wetzler, E. M. Beane, William Yeager, Frederic G. Sykes, C. S. McCalla, Cabot Stevens, Randall D. Warden, Hawthorne Hill, L. J. McDowell, Ernest Woltman, S. Edward Eaton, A. L. Holt, William Maver, Jr., A. Livingstone Bogart, Frederic Woodhull, Dr. Samuel Sheldon, Peter Cooper Hewitt.

BUSINESS NEWS

THE BROOKLYN ELECTRIC LAMP COMPANY.

The Brooklyn Electric Lamp Company was organized and the certificate of incorporation taken out in Albany last month. This company is manufacturing an entirely new line of miniature incandescent lamps and shades and also medical outfits.

This new lamp will be sold with socket intact, at the cost of the lamp alone, thus doing away with the hitherto large additional cost for sockets. This will be a great advantage to large buyers and also a saving in labor to users.

The new medical outfit is already a great seller. It consists of three different styles of lamps for all kinds of examinations; two cells of storage battery and is complete in a morocco case, 7x3x3. The whole outfit is made up in very attractive style and is ready for immediate use. Prominent physicians and surgeons all over Greater New York have testified to its great value to the medical fraternity.

Mr. C. F. Reinmann, the noted electrical incandescent lamp maker, is the managing electrician of the Brooklyn Electric Lamp Company, and his ability, well known among electrical engineers, is a great acquisition for the company. Large stock orders are already being made up for a number of wholesale buyers.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING MARCH 28, 1899, $96,584.

New York, N. Y., March 28, 1899.—The following exports of electrical material and machinery, etc., are from the port of New York for the week ending this date:

Argentine Republic—124 packages electrical material, $4,747. 33 packages electrical machinery, $1,268.

Antwerp—23 packages electrical material, $1,478. 16 cases electrical machinery, $1,850.

Berlin—5 cases electrical material, $3,488. 5 cases electrical machinery, $7,596.

British Australia—20 packages electrical material, $463.

British Guiana—27 cases electrical material, $400.

Bremen—3 cases electrical material, $155.

British West Indies—23 packages electrical material, $1,264. 2 boxes electrical machinery, $40.

Canary Islands—14 cases electrical material, $230.

Central America—88 cases electrical material, $736. 5 cases electrical machinery, $97.

Cuba—18 packages electrical material, $463.

French West Indies—1 case electrical material, $18.

Hayti—3 cases electrical material, $67.

Hamburg—157 packages electrical material, $18,118. 12 cases electrical machinery, $2,919.

Liverpool—1 case electros, $45. 17 cases electrical material, $1,658.

London—297 packages electrical machinery, $17,000. 98 cases electrical material, $8,776.

Mexico—4 cases electrical material, $139.

Marseilles—6 cases electrical material, $386.

Nice—65 cases electrical material, $13,457.

Porto Rico—66 cases electrical material, $1,215.

Peru—6 cases electrical material, $170.

Southampton—47 cases electrical material, $2,251. 19 packages electrical machinery, $188.

St. Petersburg—16 cases electrical material, $695. 12 cases electrical machinery, $1,410.

U. S. of Columbia—25 cases electrical material, $284.

Valencia—68 cases electrical material, $2,640.

Venezuela—53 packages electrical material, $418.

Zurich—3 cases electrical machinery, $455.

NEW INCORPORATIONS.

Selin's Grove, Pa.—Selin's Grove Electric Light, Heat & Power Co., incorporated by Chas. P. Ulrich and others. Capital stock $5,000.

Pittsburg, Pa.—Consolidated Electric & Manufacturing Co., incorporated by John Stadfeld, Albert Schweitzer, and others. Capital stock $6,000.

Atlanta, Ga.—The Gate City Electric Supply & Construction Co., incorporated with W. H. Turner, president; J. D. Turner, vice-president; Dr. J. P. Kennedy, secretary; Oscar C. Turner, treasurer, and general manager, and D. A. Jett, superintendent; to conduct a general electrical construction and supply business. Capital stock not given.

Newark, N. J.—William Browe & Son Co., incorporated by Walter L. Browe, George D. South and others; general electric light business. Capital stock $100,000.

East Orange, N. J.—Electric Dimmer & Appliance Co., incorporated by Arch. A. McGlashan, Joseph G. Deane and others; electric lamp dimmers. Capital stock $100,000.

Sewaren, N. J.—Sewaren Co., incorporated by Robert W. DeForest and others; gas, electric light, etc. Capital stock $125,000.

Brooklyn, N. Y.—Brooklyn Gas & Electric Light Co., incorporated by H. S. Tourly, Maurice Landauer and Frank M. Weigman. Capital stock $1,500,000.

Camden, N. J.—American Electric Power Co., incorporated by Charles L. Brown, Abraham L. English and others. Capital stock $500,000.

San Francisco, Cal.—The Independent Electric Light and Power Co. has been incorporated with a capital stock of $10,000,000, to establish in this city an electric plant that will be the biggest plant in the world.

Detroit, Mich.—National Electric Co., incorporated by F. J. Smith, F. Luce, Jr., J. F. Nichols and others; electric apparatus. Capital stock $50,000.

TELEPHONE CALLS.

Anderson, Ind.—Anderson Telephone Co., incorporated by George W. Beers, J. J. Netherville and R. H. Gadifal. Capital stock $50,000.

Minneapolis, Minn.—Southern Electric Telephone Co., incorporated by David N. Tallman, Andrew Larson and others. Capital stock $30,000.

Liberty Hall, Va.—Liberty Hall & Damascus Telephone Co., incorporated by S. P. Edmondson, J. H. Vales, R. B. Preston, P. E. Wolf and others. Capital stock $1,000.

Cambridge, Ohio.—Cambridge Home Telephone Co., incorporated by M. L. Hartley. Capital stock $15,000.

Lyons, N. Y.—Lyons Telephone Co. has been incorporated by S. E. Bishop, A. B. Bishop, E. G. Bishop and others. Capital stock $500.

Castile, N Y.—Wyoming County Telephone Co., incorporated by Miles A. Hopkins, D. E. Van Arsdale, E. B. Windsor and others. Capital stock $2,000.

Alma, Mich.—Union Telephone Co., incorporated by George Aldrich and others. Capital stock $25,000.

Linesville, Pa.—Linesville Telegraph & Telephone Co., incorporated by R. P. Reidenbach, F. E. Bunday and others. Capital stock $6,000.

Sandusky, Ohio.—Sandusky Gas & Electric Co., incorporated by Thomas B. Hoxsey, Clark Rude, Fred G. Hiltz and others. Capital $500,000.

Peoria, Ill.—Peoples' Gas & Electric Co., incorporated by O. J. Bailey, Philo B. Miles and Sumner R. Clark; furnish gas, electricity, heat and power. Capital stock $500,000.

Frederick, Ind.—The Frederick County Telephone & Telegraph Co., incorporated by D. C. Winebrener and others. Capital stock $25,000.

Dahlonega, Ga.—The Dahlonega Telephone Co., incorporated with a capital stock of $1,000.

Des Moines, Iowa.—Acme Construction Co., incorporated by J. W. Lobb, F. M. Beach and C. M. Chittenden; telephone lines Capital stock $3,000.

Little India, Ill.—Virginia & Little India Telephone Co., incorporated by Marquis L. Crum, Frank R. Virgin and L. L. Fox. Capital $600.

POSSIBLE INSTALLATIONS.

St. Michaels, Md.—The mayor may be addressed concerning proposed construction of electric light plant.

Bluefield, W. Va.—A company has been formed by William A. Cather and others for the establishment of an electric light and power plant.

Cadiz, Ky.—T. H. Fuqua, of Canton, Ky., contemplates establishing an electric light plant in Cadiz.

STREET RAILWAY NEWS.

Kansas City, Mo.—Central Electric Railway Co., incorporated by Daniel E. Holmes, Frank Hagerman, Henry C. Page. Capital stock $2,500,000.

JOTTINGS.

The Montauk Multiphase Cable Company are in receipt of a large additional order from Melbourne, Australia, for their fire detective cable. A remarkable feature in connection with this cable is that at this long distance from the point of manufacture, subject to rough usage in transportation, it at once proved its superiority in all ways for the purpose designed. It was subjected to practical tests, calling out the fire brigade in ample time for the suppression of fire, received the endorsement of Chief Stein, and subsequently the approval of the builders and architects of that city. The great fire that proved so destructive in Melbourne recently, had drawn public attention to the value of this cable for giving quick announcement of fires. A noted fire department engineer has recently stated that if he could have five minutes' notice of any fire he could suppress the same in the next five—the cable gives instant notice of dangerous heat or incipient flame.

The Knapp Electric and Novelty Company are now installed in the new building, 125 White street, near Centre, where their facilities for turning out work have been doubled. The y are now prepared to take stock orders for their 1899 fan motors for battery use. These motors are thoroughly up-to-date, are equipped with adjustable spring brushes and other improvements.

Frederick Pearce, the well known manufacturing electrician of 77-79 John street, wishes to announce to his friends and customers that on or before May first he will remove from his present location to the Metropolitan Realty Building, 214-218 William street and 18-20 Rose street. Mr. Pearce has been obliged to take this step in order to accomodate his ever growing business. The increased floor space and the convenience obtained by the removal to this modern factory building will enable him to increase his facilities for manufacturing his well known telegraph, telephone and police apparatus.

The Chemical Battery Light, Heat & Power Co. will rent and maintain their batteries for light, heat and power. Among those interested in the company are W. H. Day, John B. Day, J. E. Van Pelt and J. E. McLean. Mr. Morgan is the electrician. The offices of the company are in the St. James Building, Broadway and 26th street.

Mr. J. F. Baker has lately been appointed eastern manager of the Crouse-Tremaine Carbon Company and the Fostoria Incandescent Lamp Co., with offices at 95-97 Liberty street.

The Electrical Age.

VOL. XXIII—No. 15 NEW YORK, APRIL 15, 1899 WHOLE No. 622

TRANSMISSION OF POWER.

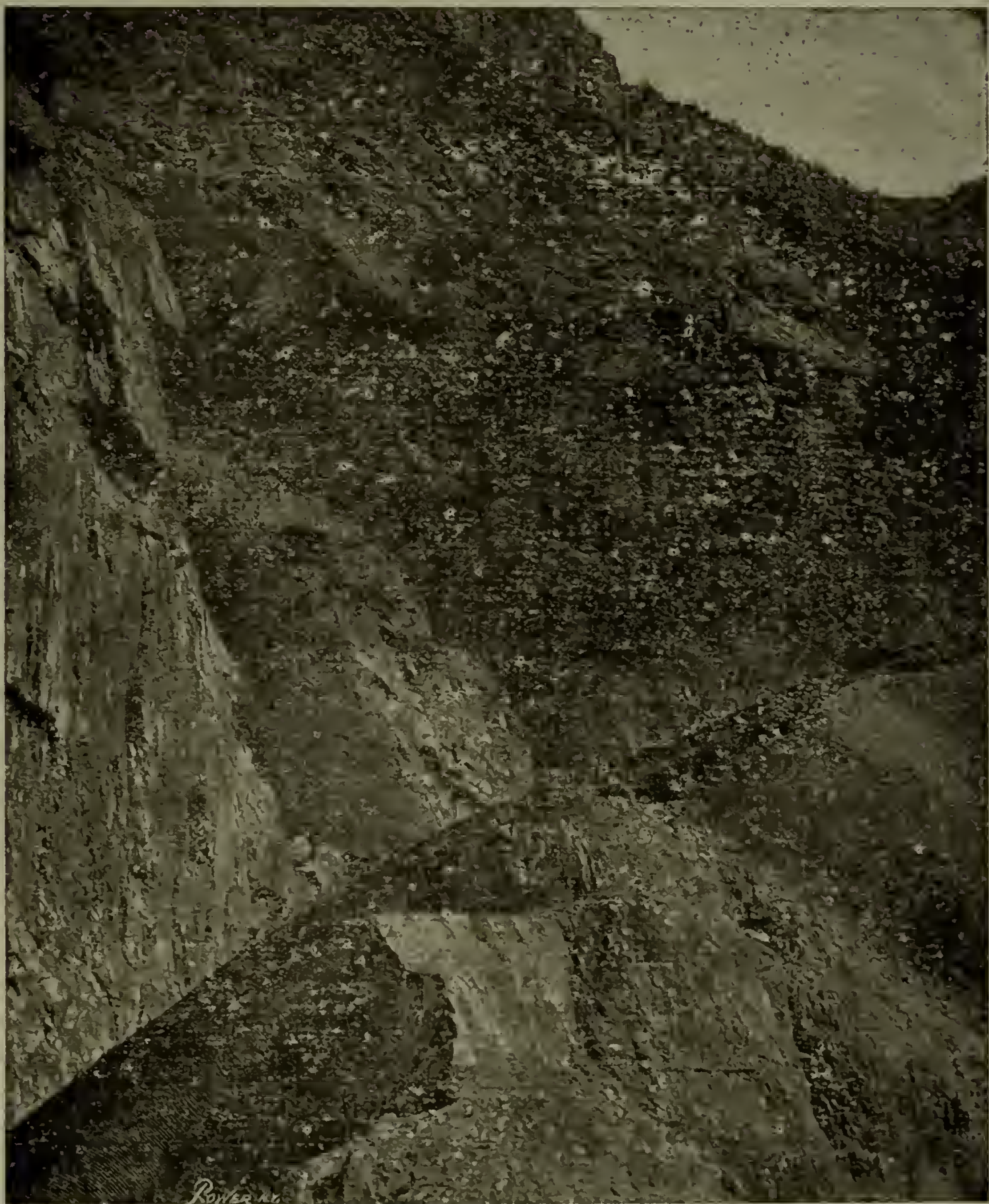


Fig. 5—Part of Stave Pipe Line.

THE ELECTRICAL TRANSMISSION AND APPLICATION OF POWER.

Through the courtesy of "Power."

In the present state of the art it would be superfluous to expatiate upon utilization of hitherto waste water powers by means of electrical transmission or to indulge in argument concerning the gain in convenience, floor space and cleanliness due to the employment of electric motors in industrial establishments. These features are matters of common knowledge. The aim of this article is rather to set forth the modern status of the two branches of engineering mentioned. The instances of transmission by electricity have rapidly multiplied during the past five years even, so that now the advisability of pursuing a project of this class is determined by mere engineering calculations based upon well established principles.

As illustrative of the recent development of electrical transmission in the United States three large plants are here briefly described, each one typical of a certain class of work. These are located at Minneapolis, Minn.; on Big Cottonwood Creek, Utah, and in the Ogden Canon, Utah. All three utilize water power for driving the generators and three-phase alternating currents, at high pressure, for transmission to a distance.

The plant at Minneapolis is of rather special interest in that it has displaced three steam stations formerly used as power houses by the Twin Cities Rapid Transit Company, whose street railway stytems extend throughout and between St. Paul and Minneapolis. All the power

for these lines is now generated at one station located on the lower St. Anthony Falls, and transmitted to various points of distribution in the railway net-work. The generating plant, shown by Fig. 1, comprises eight General Electric three-phased alternating-current generators, each of 1,000 horse power capacity, and two General Electric continuous-current generators of similar size; each generator is driven by four horizontal Victor turbines, 42 inches in diameter, coupled to the shaft of the generator. The normal speed is 130 revolutions a minute. The speed of each set of turbines is regulated by a "Type B" Lombard governor, belted to a small pulley on the generator shaft.

The continuous-current machines are used to furnish current direct to the near-by points of the railway system, and they are, therefore, ordinary railway generators as to type and voltage. The armatures weigh 34,000 pounds each, and the complete generators weigh 110,000 pounds each. The alternators are of the revolving armature type, and furnish three-phase currents at 3,450 volts and 40 cycles. The armatures are 7 feet 6 inches in diameter and weigh 25,000 pounds each. The complete alternators stand 10 feet 8 inches high above the bases, and weigh 84,000 pounds each. The field magnet poles are built up of sheet steel, "cast into" the surrounding steel frame or ring. The field magnet structure is arranged so as to slide along the base, parallel with the armature shaft, making it possible to expose the armature for inspection

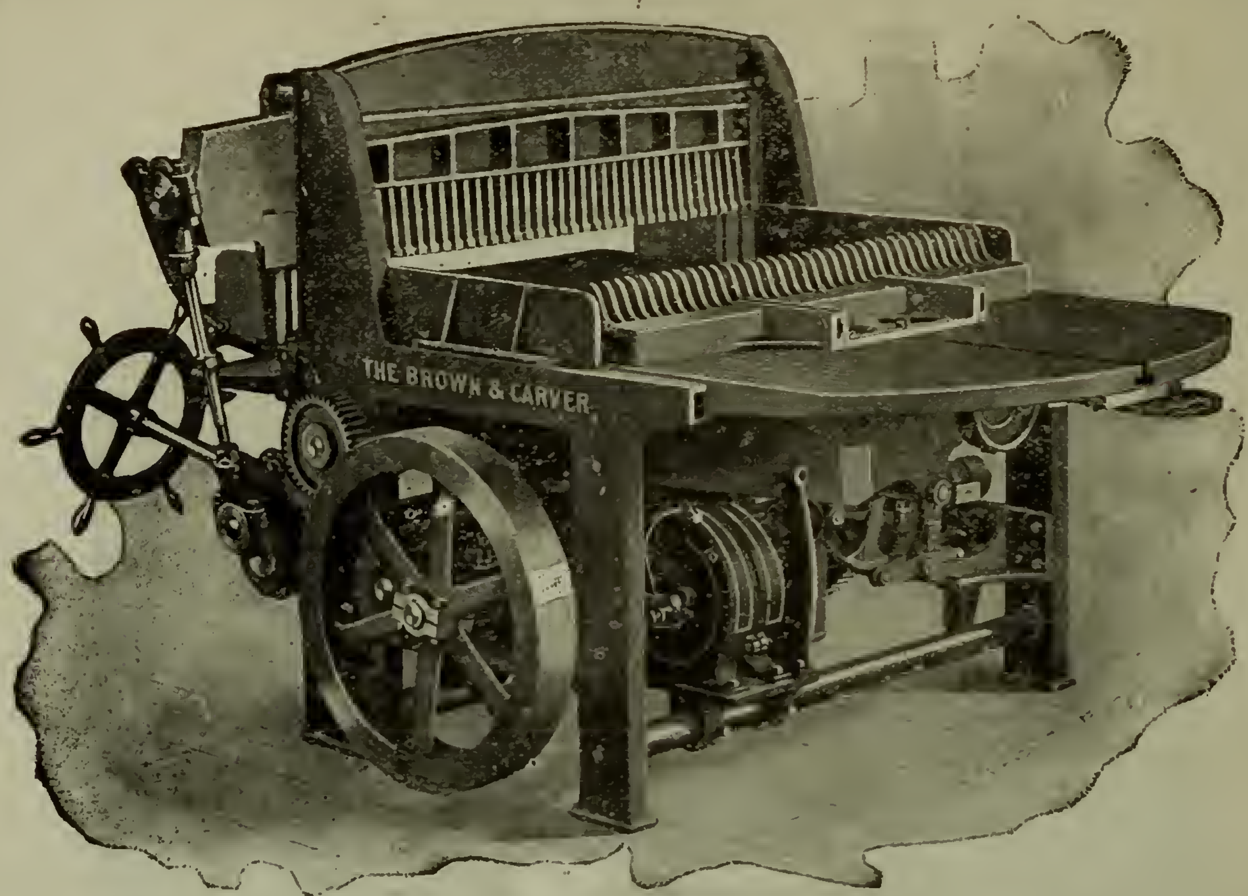


Fig. 11—Lundell Motor Driven Paper Cutter.

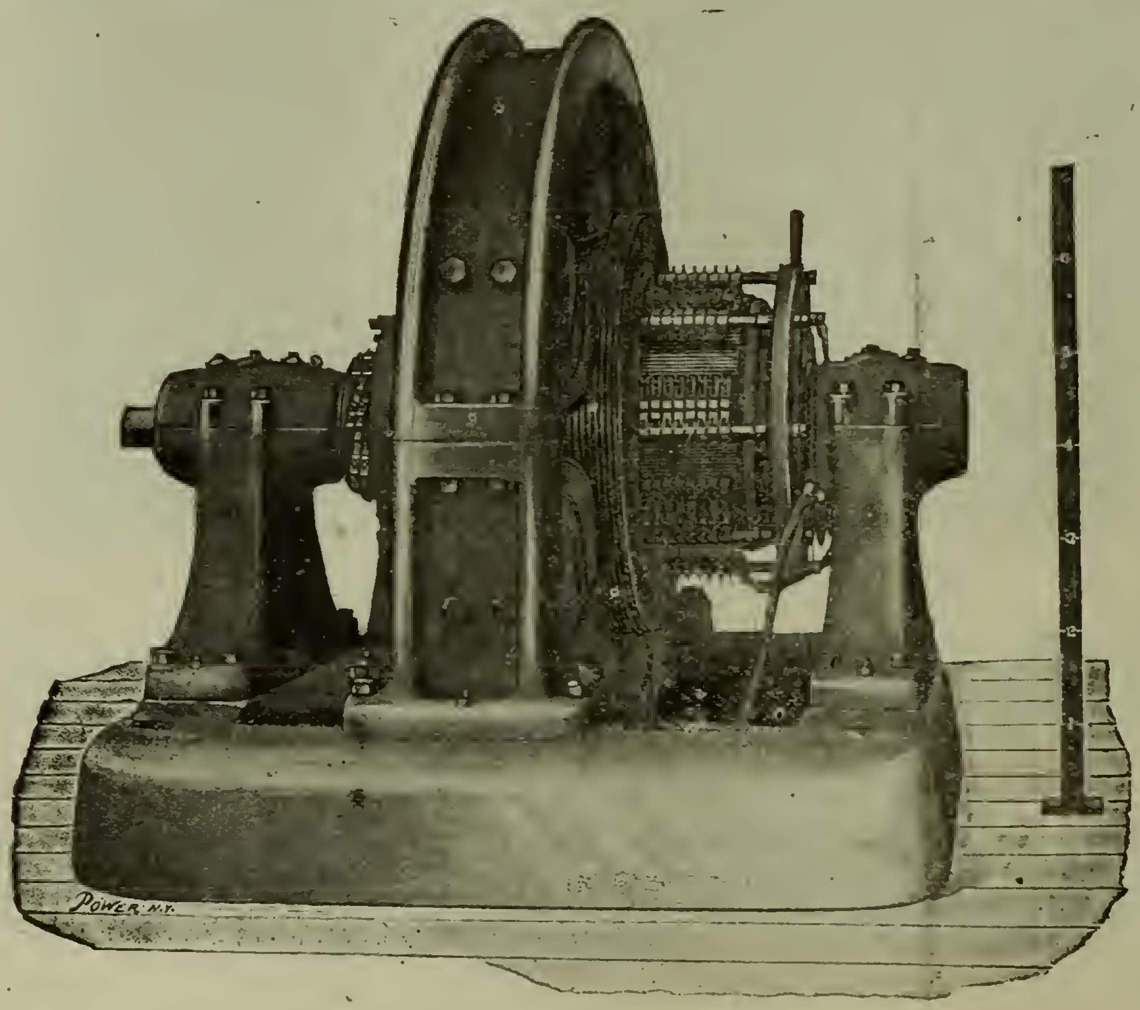


Fig. 4—Rotary Converter, St. Paul Sub Station.

or repair without dismantling the field frame or dismounting any portion of it.

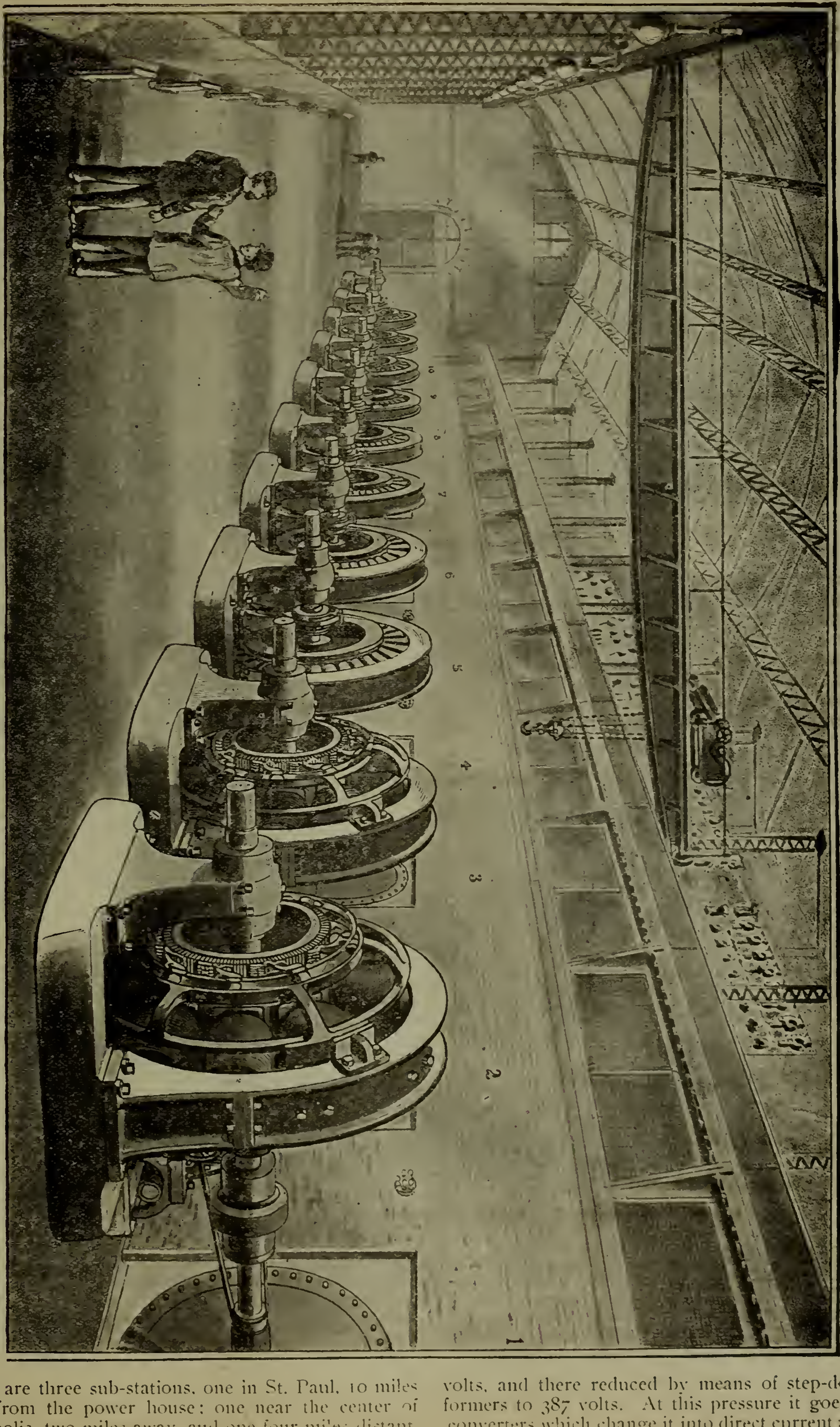


Fig. 1—View of Generator Room at St. Anthony Falls Transmission Plant.

There are three sub-stations, one in St. Paul, 10 miles distant from the power house; one near the center of Minneapolis, two miles away, and one four miles distant, also in Minneapolis. Current is transmitted to the Minneapolis sub-stations at the original pressure of 3,450 volts, and there reduced by means of step-down transformers to 387 volts. At this pressure it goes to rotary converters which change it into direct current at 600 volts.

at which pressure the railway feeders are supplied. One of these machines is shown by Fig. 4.

The Pioneer power plant in the canon of the Ogden River, Utah, forms an interesting example of the transmission to a great distance of the entire output of the generating station. Here the power house supplies about

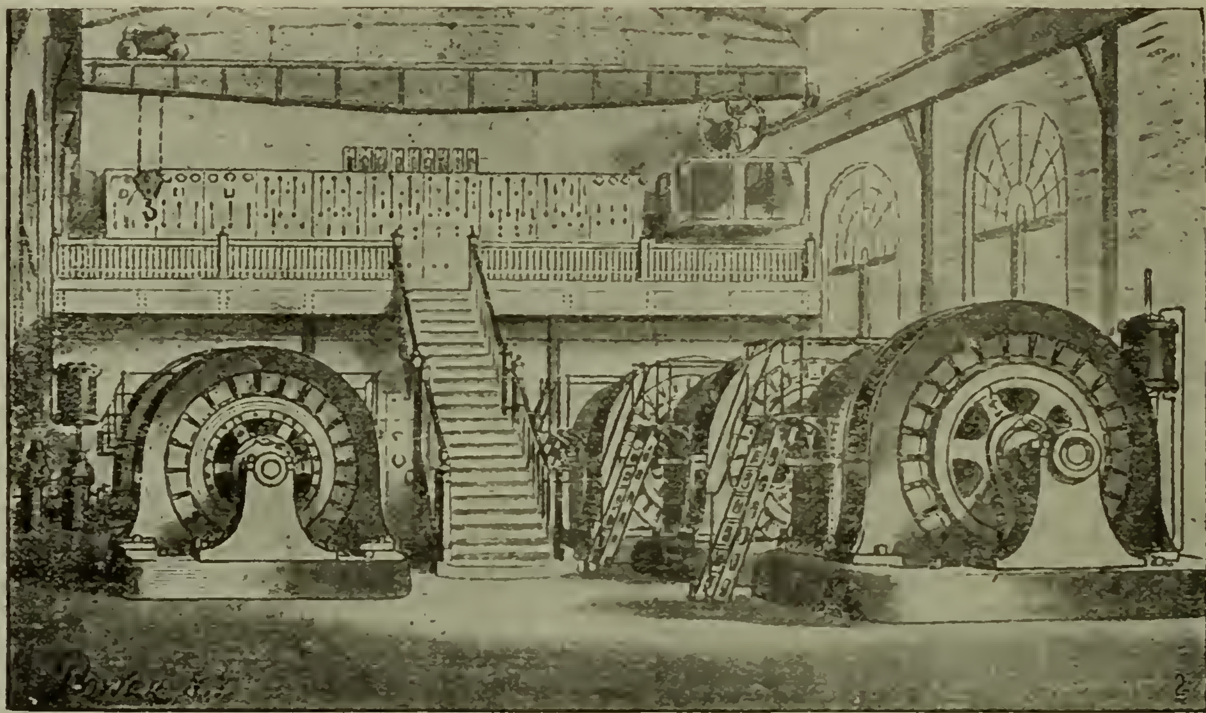


Fig. 2—Generator Room at Pioneer Plant.

5,000 horse power to the transmission lines, which carry it 38 miles to a substation in Salt Lake City, whence it is distributed by the usual central station methods.

The water reservoir is located at the upper end of the canon and covers an area of about 2,000 acres. This reservoir was formed by building a dam across the canon, which is 400 feet wide at this point. A 9 foot tunnel at the south end of the dam forms an outlet for the reservoir.

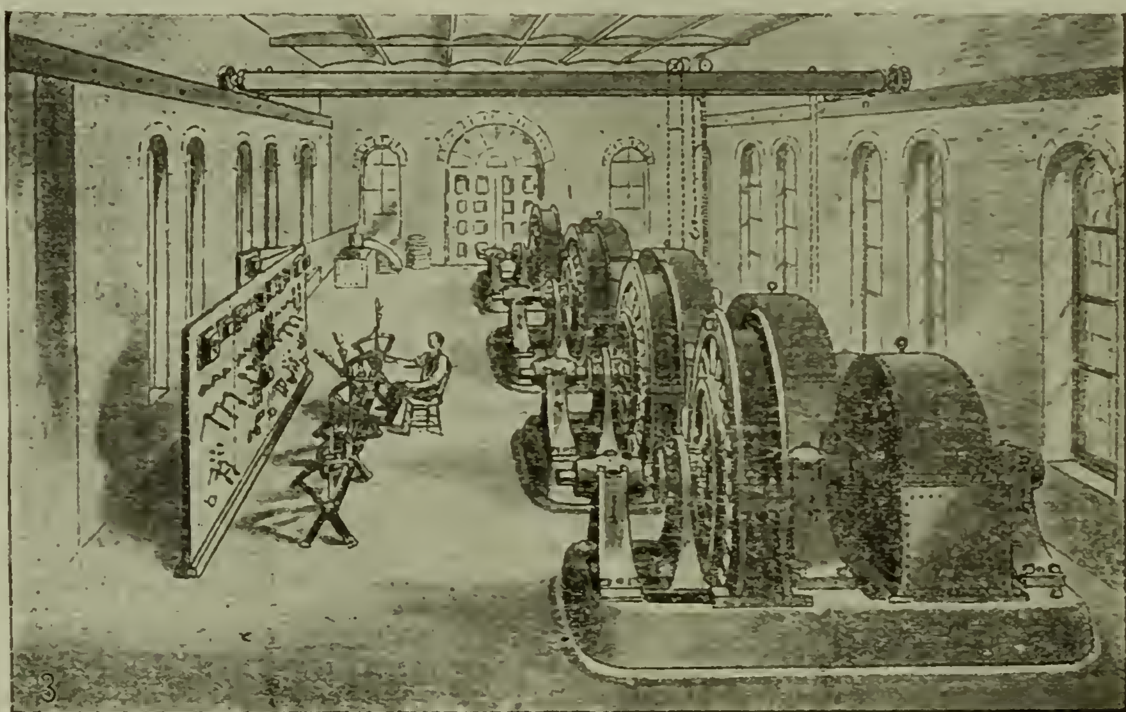


Fig. 3—Dynamo Room at Big Cottonwood Plant.

The water is led from the reservoir to the power house, 6 miles distant, by means of a pipe line 6 feet in diameter, laid in a trench 8 1-2 feet wide and 9 feet deep. Most of the pipe (27,000 feet) is built up of wooden staves, bound with 5-8 inch and 3-4 inch steel rods, the latter being used where the head exceeds 100 feet; Fig. 5 shows a stretch of this pipe line. The lower end of the pipe line is steel, built in sections. The riveting of the steel pipe in the trench was done by portable riveters, operated by compressed air at a pressure of 50 to 75 pounds; one of these machines is shown in Fig. 6. The head obtained between the reservoir and the receiver at the power house is 450 feet.

The generating plant consists of five Knight water wheels, of the impulse type, 59 inches in diameter, direct connected to five General Electric three-phased generators, of 1,1000 horse power capacity each. These units run at 300 revolutions a minute and have two fly-wheels each. Each armature shaft, pair of fly-wheels and water wheel, comprising the rotating part of one unit, weigh 15 tons. Regulation of the speed of the water wheels is effected in the usual manner by varying the opening of the nozzle ports. The levers controlling the nozzle mechanism are located near the top of the switchboard. Fig. 2 gives a view of the generator room.

In the St. Anthony Falls plant the power is partly

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CONTENTS

TELEGRAPHING ACROSS THE OCEAN WITHOUT WIRES.

The amount of enterprise exhibited by modern scientists is almost appalling when we stop a moment to contemplate the situation. The enthusiasm displayed by experimenters in chemistry, mechanics and electricity has been caught by a choice variety of wealthy investors. The electric sugar swindle is now a thing of the past. The Keeley motor is buried with its inventor and the Brown-Sequard elixir is, from a popular standpoint, a complete frost.

Telegraphing without wires has become so well recognized a department of electrical engineering that three great governments, England, France and the United States are participating in experiments aimed at the completion of a system of unquestionable practical value. The indefatigable efforts of Signor Marconi aside from newspaper comment made by the daily press and technical journals have thus far crystallized satisfactorily. Signalling across the English Channel through a raging storm, a dense fog and other conditions of an inauspicious nature prove that wireless telegraphy is no longer a dream but may develop from its present inchoate condition into a system of enormous dimensions and general application.

By dispensing with the use of wires Marconi simply impressed the world at large with the fact that the crudity of a telegraphic or signalling system and its uncertainty on many important occasions is due to the use of conductors. But he has shown nothing new. His experiments merely show that an application may be made of Hertzian waves beyond the walls of the labratory. He proves that the luminiferous ether may in time become as important an element of commercial life as iron and stone, wool and wood.

The New York Sun, of Wednesday, April 12th, contains a special cable dispatch from London reading as follows: "The formation of a commercial syndicate is proposed here with the object of acquiring the sole right to establish ether wave communication between Great Britain and the United States under the system of Signor Marconi. The French government has commissioned Signor Marconi to install his apparatus, experimentally, on a cruiser. If the experiment proves a success several French war ships will be provided with the apparatus."

During a battle when the smoke is thickest and the war ships are moving around in all directions it is an exceedingly difficult matter for the admiral to give orders with any expectation of them being received. It is impossible for them to signal by sound with the roar of cannon on all sides and the thick smoke obscuring the vision prevents any flag code from being observed. In consequence of this a telegraphic system which will operate in spite of shock and smoke would be a most valuable additon to any country's naval equipment at such a critical moment.

The French, as we see, are going to try it on their cruisers. The United States is not far behind as many experiments have been and are being tried by well known military and naval officers between shore and sea in about the same manner. We note in the above clipping from the Sun that trans-Atlantic communication will be attempted if there is any foundation for it on the strength of recent long distance trials. After a distance of one hundred miles has been successfully operated across more of the details and requirements will be known. It does not seem as though the waves could be prevented from reaching or that the curvature of the earth would seriously interfere with signals sent across a continent. The Marconi system will not displace the Western Union Telegraph Company's but will merely provide a unique means of immense value in special cases.

THE COMING ELECTRICAL EXHIBITION.

A great gathering will be on hand to view the opening of the Electrical Exhibition at Madison Square Garden May 8th. The expression of public approval was made evident by the immense crowds that surged through the exhibit hall last year. The American public are intensely interested in anything electrical and particularly so when the exhibits represent the latest of scientific applications and inventions. Some of the principal features were telegraphing without wires, an X ray parlor and a miniature cathedral, lit up by artificial daylight. There is a great probability that this year's exhibition will outvie the last in the novelty and variety of its machinery and in the exhibiting of a few things which the Exhibition Committee are keeping carefully to themselves until the opening night. It sems to us that if electrical people cannot interest Greater New York residents there is little of anything else in the world that will attract attention or excite comment.

transformed and transmitted to a distance and partly applied directly at short distances. In the Pioneer plant the hydraulic power is carried six miles for electric conversion, and transmitted a long distance electrically. The Big Cottonwood plant is a case of electrical transmission pure and simple.

A feature common to all three plants is the duplication, as far as it is practical, of vital parts of the equipment. In each plant, for example, two exciters are used, one of which is amply able to take care of the entire generating plant. The generating plants are divided up so that a mishap to one machine would not dangerously overload the remainder; so, also, are the transformer plants.

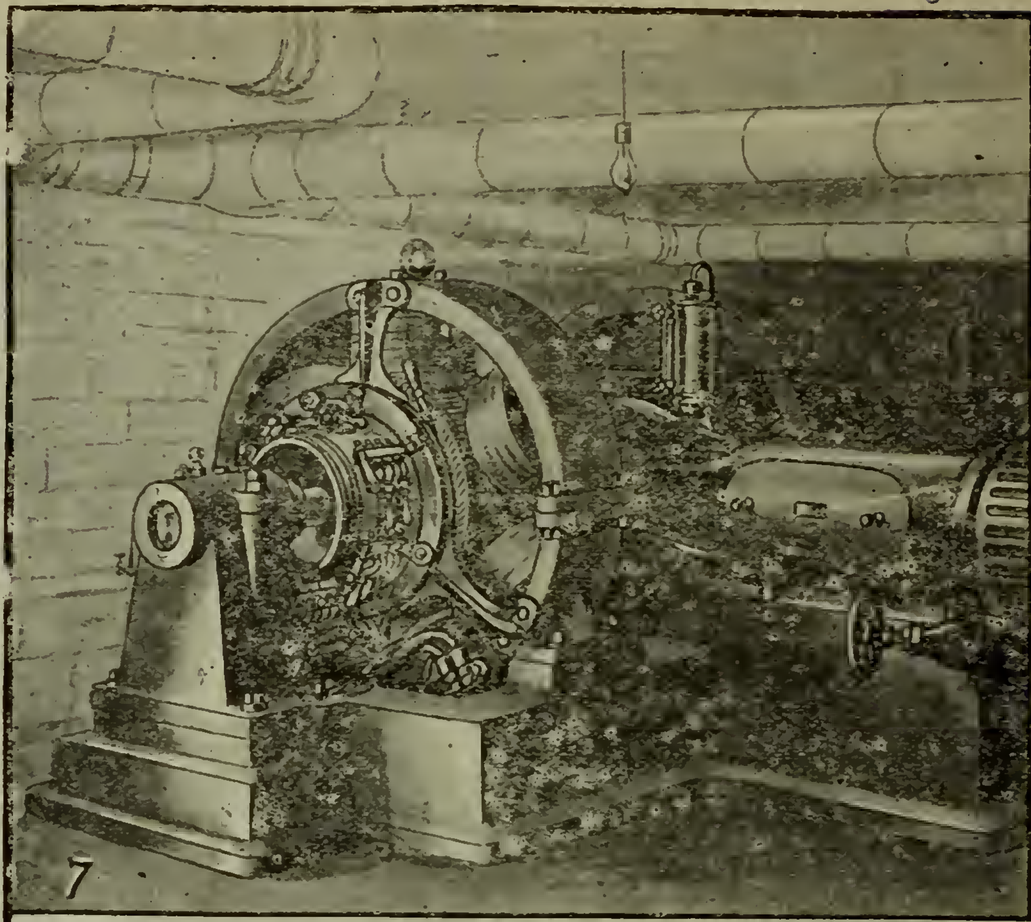
Next in interest to the generation and transmission of power by electricity comes its industrial application by the same medium. Instances of such application are legion, and only a few, therefore, of the most recent examples are here described. One of the industries in which electric motors have been found superior is the publishing business. Here the economy in head room, efficiency in power consumption and increased accessibility have combined to give the application of motors to printing office machinery an impetus which will probably last as long as there is a half-medium job press undriven by this kind of power.

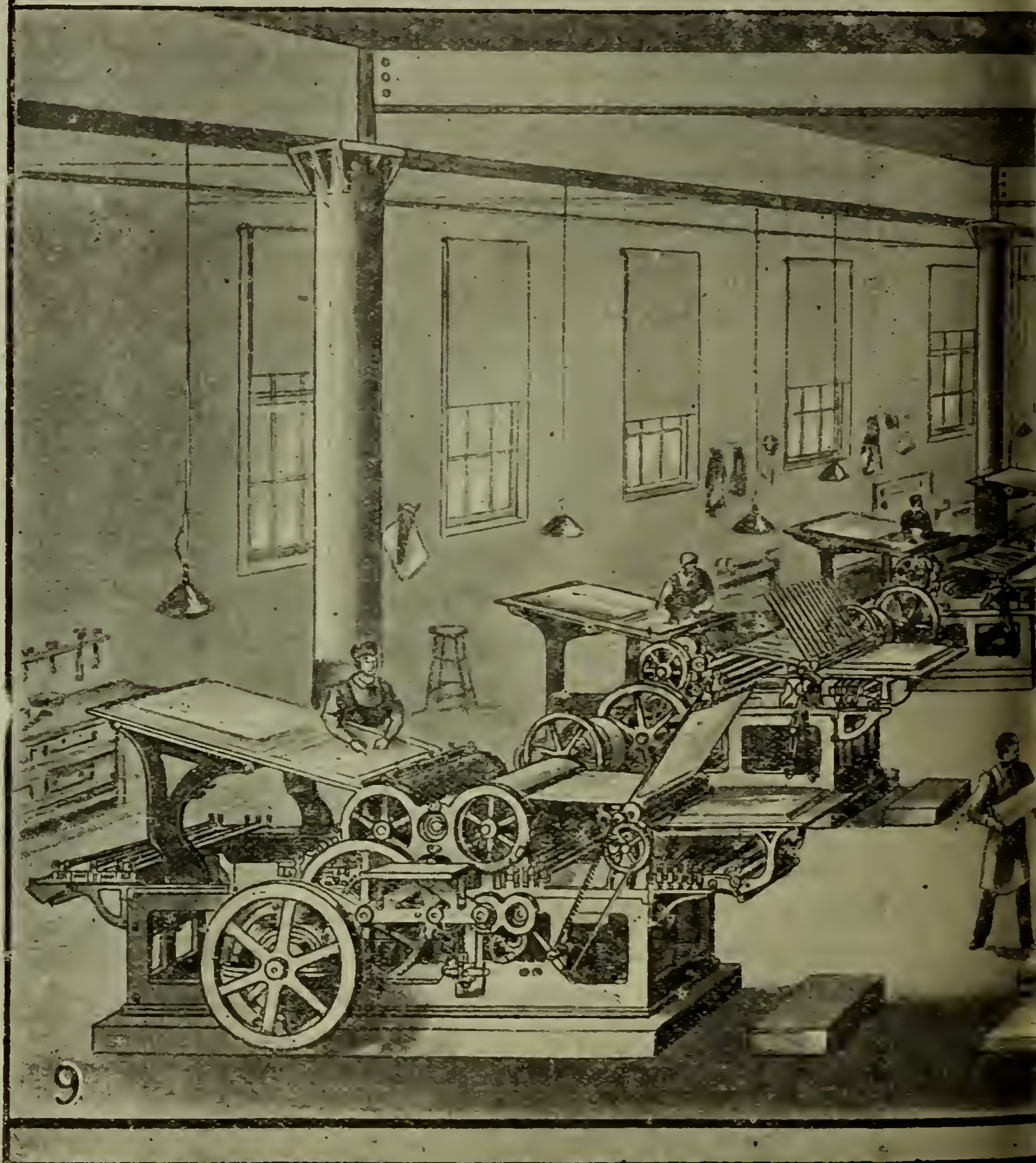
One of the latest installations in printing offices is owned by the Butterick Publishing Company, of New York, where fourteen large cylinder presses are driven by Crocker-Wheeler motors, and the remainder of the plant, comprising 37 presses, a number of paper cutters, etc., is in process of equipment. The company operates its own generating plant, consisting at present of a 125-horse power horizontal return tubular boiler with a Hawley down draft furnace and two 75-horse power Payne automatic engines, direct connected to 50-kilowatts Crocker-Wheeler multipolar generators, with the usual accessories.

One of the engines and generators is shown by Fig. 7. The engine is a simple 13x12, and drives the generator at 275 revolutions. The armature is of the usual toothed core type. The field magnet has six poles, with pole shoes of special shape designed to eliminate sparking at the brushes. The output is 220 amperes at 230 volts, at which potential the motors are operated. The circuits extend throughout the plant for the purpose of supplying 220-volt incandescent lamps which are used to light the establishment.

Fig. 9 gives a view of the pressroom already equiped with motors and Fig. 8 shows a single equipment. The motors are all mounted directly on the driving shafts of the presses, avoiding all gearing and belting. The present equipment comprises three two-color presses, 35x51 inches, driven by 7 1-2 horse power motors; one press 42x60 inches and four presses 35x61 inches, driven by 5 horse power motors; two presses 42x60 inches and one press 35x51, driven by 3 1-2 horse power motors; two presses 34x50 inches driven by 2 1-2 horse power motors, and one small press driven by 1-2 horse power motor. Each motor is controlled by a hand lever at the pressman's side, which operates the starting and regulating rheostat, and the control is so complete that is is common practice to "turn over" the press by means of the motor, except, of course, when extreme accuracy in stopping is desired; in this case the hand wheel is used.

As indicated in this last case, the usefulness in a printing establishment of electric motors is by no means restricted to driving the presses. Figs. 10 and 11 show applications which have found favor in a large number of publishing houses, the one being a linotype machine and the other a paper cutter, driven by Lundell motors through single-reduction gears. The motor on the linotype machine is of 1-4 horse power capacity and a noticeable feature of the combination is the ease with which the motor is made an inconspicuous part of the linotype machine structure. But for the wires in and near the central opening of the motor and the flexible cord connecting overhead one might never notice its presence.



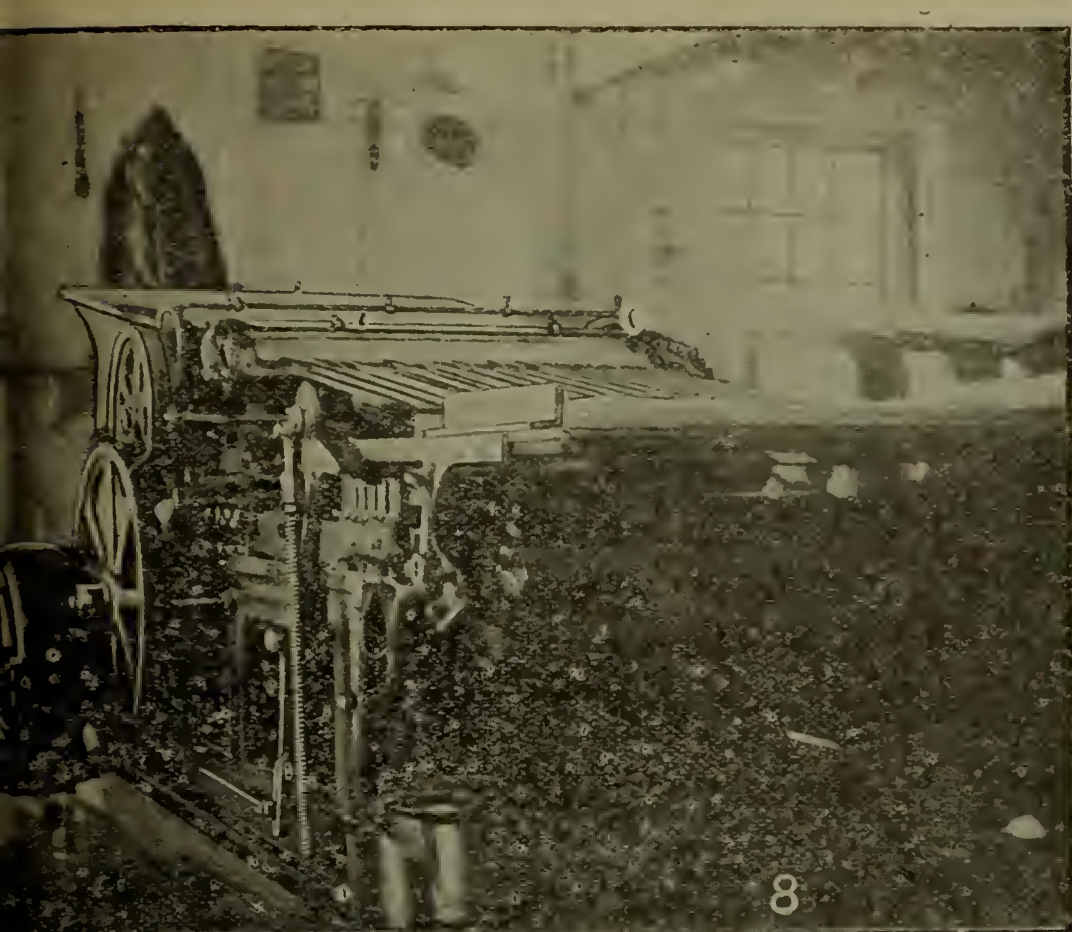


Generating Unit, Press Unit, and Electrically Driven Pres

These machines have been adopted by several of the large periodicals, notably the American Machinist, the German

Herald and McClure's Magazine.

The paper cutter shown is a 56-inch machine, driven by a 3-horse power motor. The power required by such



Room of the Butterick Publishing Co., New York.

a machine depends, of course, upon the character of the work done by it. For ordinary cuts on paper a 2-horse power motor is sufficiently large to drive almost any size of cutter. Where mill board is to be cut in quantity or extra heavy cuts on paper are common, the usual sizes are one horse power for blades up to 34 inches long, 2 horse power up to 44 inches, and 3 horse power up to 60 inches. For this service an electric motor is peculiarly adapted, if well built. The load comes with a blow and lasts only a few seconds, so that by designing the motor to withstand heavy shocks a much smaller machine may be used than would be required in the case of a steam engine. Any good motor will stand 100 or 150 per cent. overload for the few moments necessary to make a cut, so that to drive a paper cutter the blade of which requires 5 horse power to force it through a maximum cut, a 2-horse power motor will usually be found heavy enough, and it will always be safe to use a 2 1-2 or 3-horse power motor. Where it is feasible, some additional saving may be effected by driving several cutters from one shaft, the shaft being direct coupled to a motor. The work being intermittent, the motor will not need to have a capacity equal to the combined demands of all the cutters unless they all do work continuously for several hours at a time.

The power actually consumed by a 48-inch paper cutter during a test made by the writer was 1-4 horse power running free and 2 horse power for a cut 46 inches wide and about 3 inches thick. The material was 75 pound machine-finished book paper, 33x46 inches. A cut of 2 inches through 120-pound calendered paper 30 inches wide, on a 38-inch cutter, showed 1 7-100 horse power, as nearly as the ammeter and voltmeter indications could be read. The error, if any, was against the motor. In both cases the motor was belted direct to the pulley of the paper cutter, which ran continuously, the knife mechanism being driven by the usual clutch arrangement. The motors were 1 1-2 horse power machines.

A totally different line of work is illustrated by Figs. 12 to 15, which show applications at the foundry of the Healey Iron Works, Brooklyn. Fig. 12 shows a 5-horse power Crocker-Wheeler motor, of the familiar bi-polar type mounted upon a jib crane and geared to the winding drum. There are six of these cranes in use in the foundry. Their swing is 30 feet, and one man handles each crane. With the hand hoist formerly used six men took 25 minutes to hoist a 5-ton ladle, after filling, to get it in position to pour. With the motor arrangement one man does precisely the same work in 3 minutes. Estimating the time of pouring at 5 minutes, a motor equipment run by one man will allow the pouring of 50 tons of metal an hour by each gang of men, while it would require hard work to fill and pour 10 tons an hour per gang, using six men at the crane, with the hand hoist, to say nothing of the greater difficulty due to cooling during the hoisting of the ladle.

Fig. 13 shows a boom crane used in the foundry yard for handling pig iron and castings. This is equiped with a 3-horse power motor geared similarly to the foundry crane machine. Fig. 14 shows a 40-horse power four-pole Crocker-Wheeler motor belted to a Sturtevant blower which supplies the blast for two cupolas, one of 20 tons and the other of 35 tons capacity. An idler is used on the top stretch of the belt, very close to the motor pulley, in order to increase the belt surface of the latter. Although idlers are generally regarded as unmixed evils, this one appears to give no trouble whatever, and the entire outfit is reported by the owners as having been a most complete success from the time of first starting up. In the upper center of the engraving will be noticed a bi-polar motor belted to machinery not shown. This is a 10-horse power machine which drives the machine shop, being simply belted to the line shaft of the shop. The tools driven from this line shaft are a pony planer, a Fox lathe, 4 drill presses, ranging from 24 to 36 inches swing, a large radial drill and a punch and shear for heavy sheet and strap iron.

Fig. 15 shows a special type of lathe used in the Healey foundry for finishing up the ends of cast iron columns. It has two head-stocks, spindles and face plates, each spindle being driven through back-gearing by a 5-horse power motor. The work is mounted on the bed between the face plates and the tools are carried on the latter. A power feed is provided which carries the tool to or from the center of the plate; adjustment toward and from the work is made by hand. Two headstocks and face plates are employed in order to finish both ends of a column at

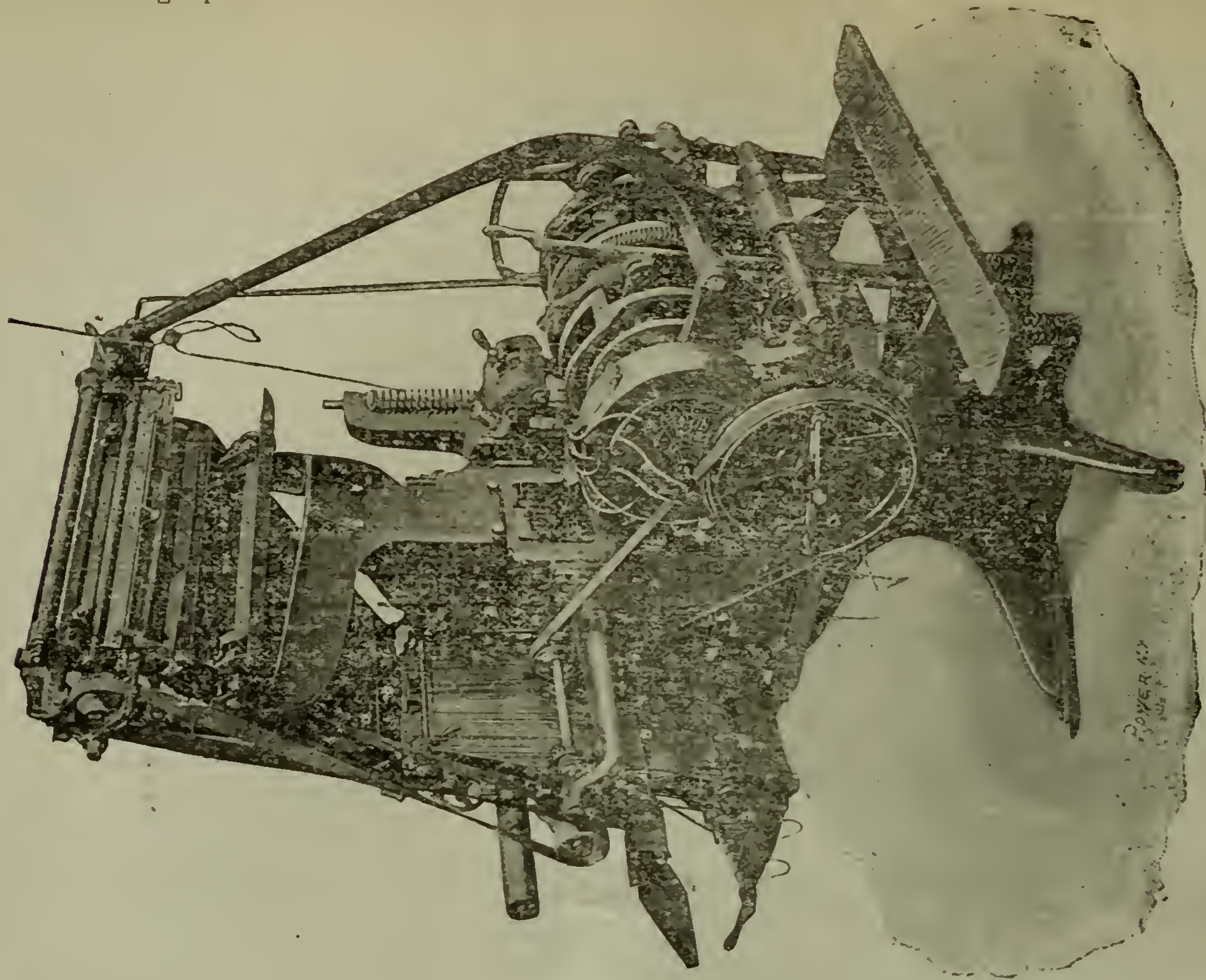


Fig. 10.—Combined Linotype Machine and Lundell Motor.

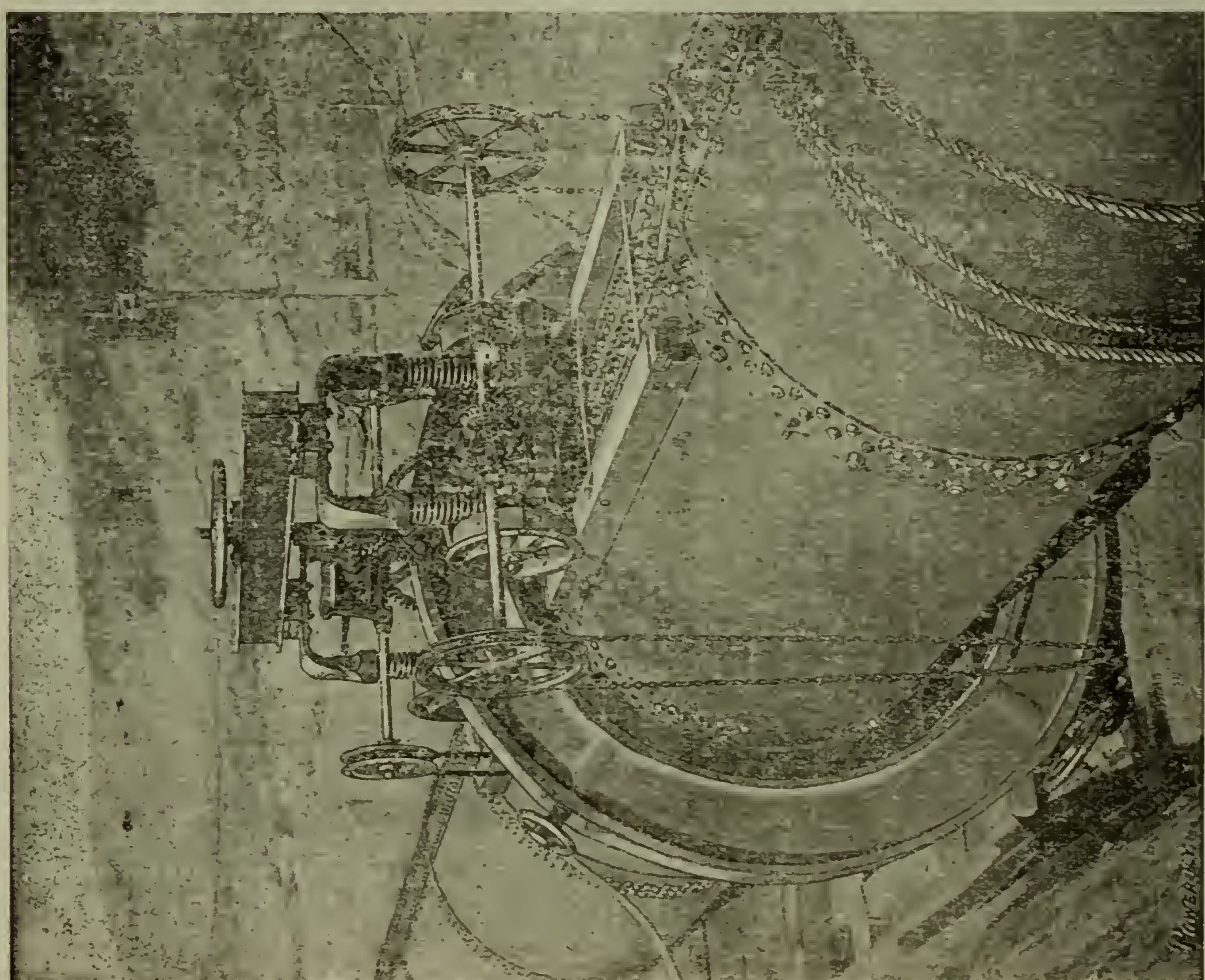
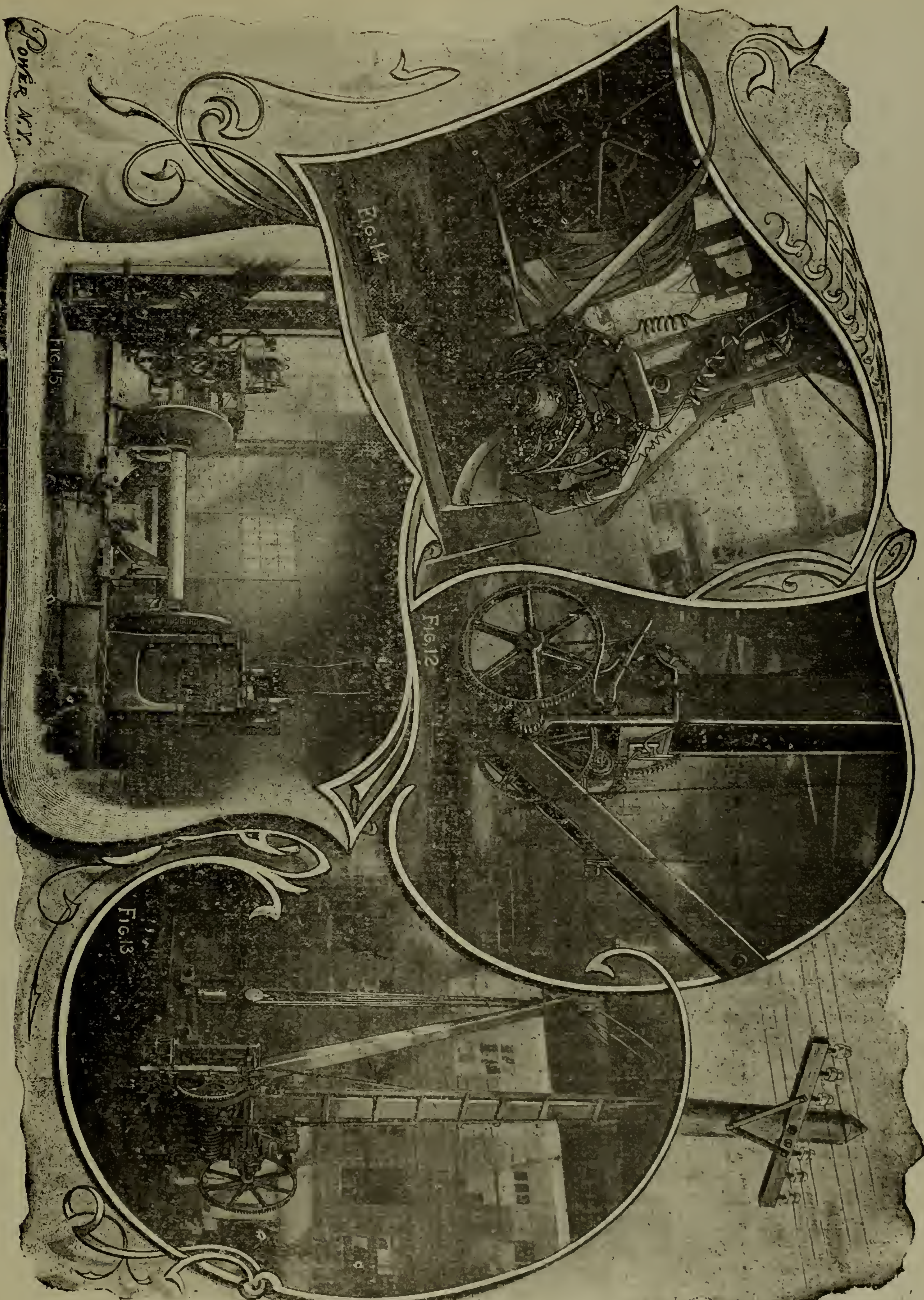


Fig. 6—Partable Riveting Machine.

one setting. A rather singular feature of this foundry plant is that none of the motors is boxed in or protected in any way, except the 40-horse power blower motor,



The Application of the Electric Motor at the Healey Iron Works, Brooklyn, N. Y.

which has a housing of boards (removed through the courtesy of the superintendent, Mr. Miller, for photographing); yet they all run along without giving any trouble whatever, with foundry dust thick on their stationary parts. Besides the motor illustrated there is a 3-horse power machine which drives the pattern shop tools, comprising a band saw, a 12-inch circular saw and a 24-inch speed lathe, a short line being driven by the motor.

The Healey foundry machinery, except the cranes, was formerly driven by a local steam plant, through the conventional shafting and belting. Two engines were used,

a 25-horse power engine during 6 1-2 hours of each working day and a 50-horse power engine during the remaining 3 1-2 hours, when the cupola blower was in service. The owners of the establishment state that their bills for electric service for the present plant (including the seven cranes, formerly worked by hand) average almost exactly one half of the previous expense for coal and an engineeer, and the expense for water is now less than 55 per cent of what it was when the steam plant was operated. Besides these savings, the seven cranes are now operated to inffinitely better advantage on account of the enormous economy in the time required to lift a ladle for pouring.

As in the case of printing machinery, machine tools of all kinds show considerable economy in operation by means of individual electric motors over belt and shaft driving. The preference in England appears to be in favor of grouping the tools and using 15 to 25-horse power motors, and this plan is undoubtedly economical when the tools are worked with a fair degree of continuity. In shops of moderate output and comparatively large capacity (an apparent illogical condition which is, nevertheless, frequently found) individual motors are undeniably more economical as to operating cost, except in the case of very light running tools.

Tests made recently in the shops of the Midland Railway, Leeds, England, showed some interesting results. A 2-inch line shaft, 98 feet long, with 12 bearings, was driven by an electric motor. Running free it used a trifle under 3-8 horse power. With 15 comtershafts belted to it, a little over a horse power was consumed. With one 9 1-2 inch lathe cutting at the rate of 4 1-2 ounces of turnings per minute the total power consumed was 1 6-10 horse power. Driving the lathe direct winth a 1-2 horse power Lundell motor the total power required to cut exactly the same quantity of metal was 0.827 horse power. With the 15 tools all at work the total amount of power required was 3 3-8 horse power. The tools were all small machines, the 9 1-2 inch lathe being the largest one of the lot. The net power absorbed by the tools was not quite 2 3-8 horse power and that used by the shafting was a little over one horse power. The loss by friction in such a plant is, of course, high, and the percentage increases with intermittent use of the tools. On the other hand the first cost of 15 motors of 1-4 to 1-2 horse power would be high compared with that of a 5-horse power motor and the shafting. Estimating the cost of small motors at $50 each, belted to the tools, and that of the 5-horse power motor, line shaft, belts, etc., at $300, the latetr will cost two-fifth as much as the former.

It therefore resolves into a mere matter of shop practice as to whether the power wasted by the shafting and belts costs more than the loss in efficiency of the small motors added to the interest on $450. Assuming the cost of power to be 10 cents per kilowatt per hour and that the tools in the shop average half time, actual work, the comparison would stand about thus:

Cost of shafting arrangement..................	$300.00
Cost of individual motor arrangement..........	750.00
Cost of power per day for shafting arrangement..	1.65
Cost of power per day for small motors........	1.07
Interest on $450 per day at 6 per cent..........	.08
	$1.15

This shows a net saving by the individual motor equipment of 50 cents a day. Depreciation is omitted because the figure for one arrangement will about offset that for the othter; if there were any difference it would be in favor of the small motors, provided a suitable type were used. It is also assumed in the above calculation that the small motors will have 80 per cent of the efficiency of the large one. The average of half time actual work is a rather liberal one for general machine shop practice. In many shops a goodly proportion of the tools will hardly average one-third full time, and in such cases distributed electric motors present still greater advantages as compared with shafting and belting.

MISCELLANEOUS.

Recent experiments were made by Mr. Zeynek, who found that the sensation of taste produced by an electric current through the tongue was dependent on the voltage. He measured the current and voltage with a platinum plate below the tongue and a platinum point above it, and endeavored to find whether there is any change in the sensation of taste corresponding to the sudden bends in the curve of the current and voltage, which correspond to the beginning of the setting free of ions. This, he found, was the case; when the platinum point is made the cathode, then, at 1.45 volt, an astringent taste is produced; and when it is the anode at 1.2 volt, there is a strong acid taste. This is believed to prove that the phenomenon of the electric taste is an electrolytic one.—Ex.

Under instructions from Washington, Lieutenant-Commander L. C. Heiller has reported at the Brooklyn Navy Yard for the purpose of opening a school of instruction in electricity for naval apprentices. The school will be opened in the equipment department and will provide a complete course in all electric branches brought into use on naval vessels.—Ex.

BUSINESS NEWS

NEW DEVICE FOR IGNITING WELSBACH LIGHTS IN SERIES.

The reduction in price of Welsbach lights has greatly increased the demand by those limited to gas as an illuminating agent, not only on account of the greater economy

Fig. 1.

in consumption over the old style of burners, but in the vastly increased candle power per foot of gas. The diffi-

culty of igniting these lamps in elevated fixtures limited their use until the old form of electric gas lighting apparatus was modified so as to be applicable. In lighting a number of these lamps in series, by coil or frictional machine, the chimney and the delicate mantle presented conditions of considerable embarrassment i the attachment of the spark electrodes, as not only had ample insulation to be provided in a narrow and contracted space in the lamp parts, as turned out by the manufacturers, but at the same time the mantle must not be endangered.

The A. L. Bogart Company, of 123 Liberty street, New York City, who have for a long time made a specialty of electric igniting attachments for this class of lamps, have lately put on the market the extremely simple and con-

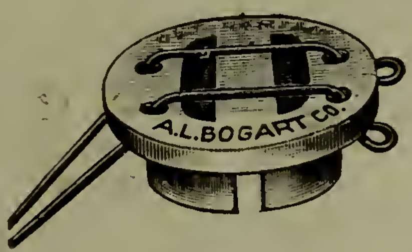


Figure 2.

venient device for series spark lighting, illustrated in Fig. 1, which is particularly adapted for use with the Welshbach with mica chimneys. The two electrodes are rigidly attached to the porcelain holder provided with a slot in its base, which embraces the top of the mica chimney, as shown in Fig. 1. Figure 2 shows electrode holder or clip on an enlarged scale. A porcelain pillar is also supplied, which insulates the metal work of the entire lamp. With this device no alteration or cutting whatever of the lamp is necessary. The electrode spark-points are below the level of the top of the chimney so that draughts of air cannot divert the stream of gas from the spark.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING APRIL 4, 1899, $86,477.

New York, N. Y., April 4, 1899.—The following exports of electrical material, machinery, etc., are from the port of New York for the week ending this date:

Antwerp—80 cases electrical material, $5,045.

Argentine Republic—9 cases electric fans, $289.

Brazil—78 cases electrical material, $6,804.

Berlin—1 case electrical material, $480; 1 case electrical material, $2,065; 10 cases electrical material, $350.

British West Indies—1 case electrical material, $20.

British East Indies—4 cases electrical material, $81.

Bremen—2 cases electrical material, $30.

Cuba—34 packages electrical material, $660.

Central America—4 packages electrical material, $176.

China—16 cases electrical material, $300.

Ecuador—15 packages electrical material, $260.

Hamburg—50 packages electrical material, $2,887; 11 packages electrical machinery, $5,951.

Genoa—2 cases electrical machinery, $41.

Havre—1 case electros, $75; 23 cases electrical material, $1,354; 25 cases electrical machinery, $150.

Japan—16 packages electric cranes, $2,525; 84 packages electrical machinery, $6,082; 8 cases electrical material, $184.

Krementeburg—85 boxes electrical machinery, $13,-648.

Liverpool—44 packages electrical material, $2,889.

London—80 cases electrical material, $6,091; 5 cases electrical material, $190.

Mexico—133 cases electrical material, $1,869.

Nova Scotia—1 case electrical material, 34.

Nice—61 cases electrical material, $19,093.

Newfoundland—1 case electrical material, $17.

Oporto—25 cases electrical material, 5,957.

Siam—3 cases electrical material, $4.

Southampton—18 packages electrical machinery, $202.

Stockholm—4 cases electrical machinery, $400.

U. S. of Columbia—2 cases electrical material, $34.

Venezuela—53 packages electrical material, $240.

NEW INCORPORATIONS.

Camden, N. J.—Fishers Island Electric Light, Heat and Power Co. has been incorporated by E. M. Ferguson, Robert Linderman, Garrett B. Linderman, Walton Ferguson and Henry Gordon; electric light, heat and power. Capital stock $10,000.

Portland, Me.—Chase-Shawmut Co. has been incorporated by Chas. Sprague, Frank W. Stone, Josiah H. Drummond and others; electrical and other machinery. Capital stock $300,000.

Springfield, Mass.—Craig & Craig Co. has been incorporated by Bertram J. Craig, Stedman W. Craig and Alfred W. Gardiner; electric fixtures, etc. Capital stock $15,000.

San Francisco, Cal.—Independent Electric Light and Power Co. has been incorporated by Claus Spreckles, John D. Spreckles, Adolph Spreckles and others. Capital stock $10,000.

Wheeling, W. Va.—Consumers' Electric Co. has been incorporated by John E. Wright, W. C. Hanlan, Samuel W. Harper, Jas. Steadman, George E. House. Capital stock $500,000.

Springfield, Ill.—Chicago Electrical Vehicle Co., has been incorporated by Edward Brewster, Samuel Insull and others. Capital stock $2,000,000.

POSSIBLE INSTALLATIONS.

Winnipeg, Man.—A $60,000 civic electric lighting plant will be established.

Charleston, W. Va.—A $4,000 electric light plant is to be established and E. R. Roberts, of Cleveland, Ohio, has been appointed to furnish plans and specifications and superintend the erection of same.

Eldorado Springs, Mo.—An electric light plant will be established.

BUSINESS CHANGES.

Richmond, Ky.—The Richmond Electric Co. has amended its charter, increasing capital stock to $15,000 from $10,000.

Seneca Falls, N. Y.—The Senaca Electric Light and Power Co.'s plant has been sold at foreclosure sale by Frederick Manning and bid in by General Electric Co. for $10,000.

TELEPHONE CALLS.

Paducah, Ky.—Henry Biederman contemplates organizing a stock company to establish a telephone ststem.

Frederick, Md.—The Frederick County Telephone & Telegraph Co. has purchased and will extend the plant of the Interstate Telephone & Telegraph Co.

Columbia, S. C.—J. A. Helvin, H. J. Simmons and Robert Moorman have petitioned the city council for franchise to construct and operate a system of telephone and telegraph. Capital stock $25,000.

Dellwood, N. C.—A telephone system is to be constructed from Dellwood to Waynesville and other cities. A. J. Sherrill of Iredell County is soliciting subscriptions for the establishment of same.

Damascus, V.—The Liberty Hall & Damascus Telephone Co. has its line in operation from Damascus to Liberty Hall to Glade Spring.

Vine Grove, Ky.—The Old Kentucky Telephone & Telegraph Co. has been incorporated by D. R. Pendleton and David Prewitt. Capital stock $5,000.

New Paynesville, Minn.—The Western Stearns Telephone Co. will be organized for the purpose of building a telephone line from this village to connect with a number of the smaller villages in this county.

Syracuse, N. Y.—The Mohawk River Telegraph and Telephone Co. has been incorporated by Russell R. Stuart, Daniel O'Brien, John Holihan, William Mason and others to operate a telephone and telegraph system. Capital stock $21,000.

Wilkinsburg, Pa.—The Wilkinsburg Telephone Co. has applied for charter to construct a telephone line.

Romney, Ind.—The Tippecanoe Telephone Co. has certified to an increase of capital stock from $10,000 to $20,000.

STREET RAILWAY NEWS.

Adrian, Mich.—Jackson & Adrian Electric Railroad, incorporated by Chas. E. Townsend, Chas. H. Smith, Chas. A. Blair and others; electric railroad from Jackson to Adrian. Capital stock $50,000.

JOTTINGS.

We notice in our double headed contemporary that the Electric Appliance Company, of Chicago, has lately brought out a new attachment for the lighting of Welsbach burners. The fact is, however, that the A. L. Bogart Company, of 123 Liberty street, have patents covering all methods of electrically lighting Welsbach burners and have been doing a large business in furnishing Welsbach burners with automatic electric gas lighting attachments, etc. All the armories in Greater New York have been fitted up with Welsbach burners equipped with the Bogart multiple electric gas lighting attachment.

M. W. J. Bramhall, 141 Broadway, the resident manager of the Standard Thermometer & Electric Company, the manufacturers of the popular Midget enclosed arc lamp and all styles of open and enclosed arc lamps for various circuits, reports business as being very active at present for this time of the year. Mr. Bramhall is an old arc lamp man and very popular among the trade generally.

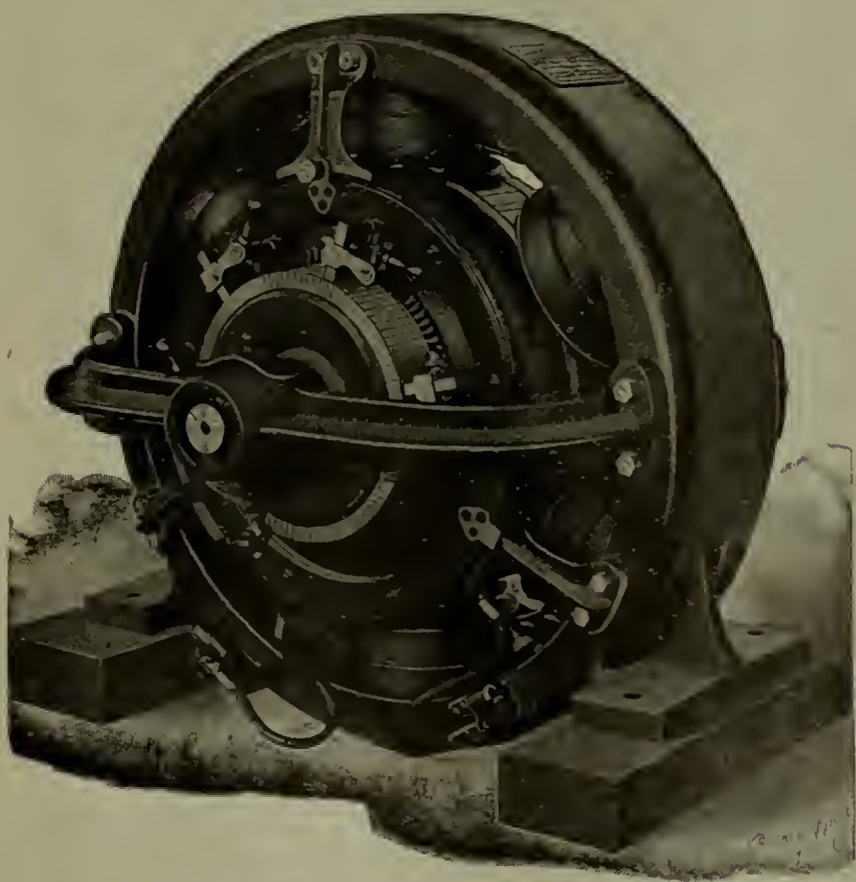
E. B. Latham & Company, of 136 Liberty street, have issued a new catalogue of 1899 Tuerk ceiling, desk and bracket fans for use on alternating and direct current circuits. Copies of this catalogue will be sent on application.

The Weston Electrical Instrument Company are making contracts for their new factory at Waverly, N. J., a suburb of Newark. A railway switch is now being constructed to the spot and ground will be broken in a few days for the erection of what will probably be the most complete manufacturing establishment in the United States.

The Electrical Age.

Vol. XXIII—No. 16 NEW YORK, APRIL 22, 1899 Whole No. 623

ELECTRIC LIGHT AND POWER.



Direct C.-W. Motor, With Bearings and Plain Feet

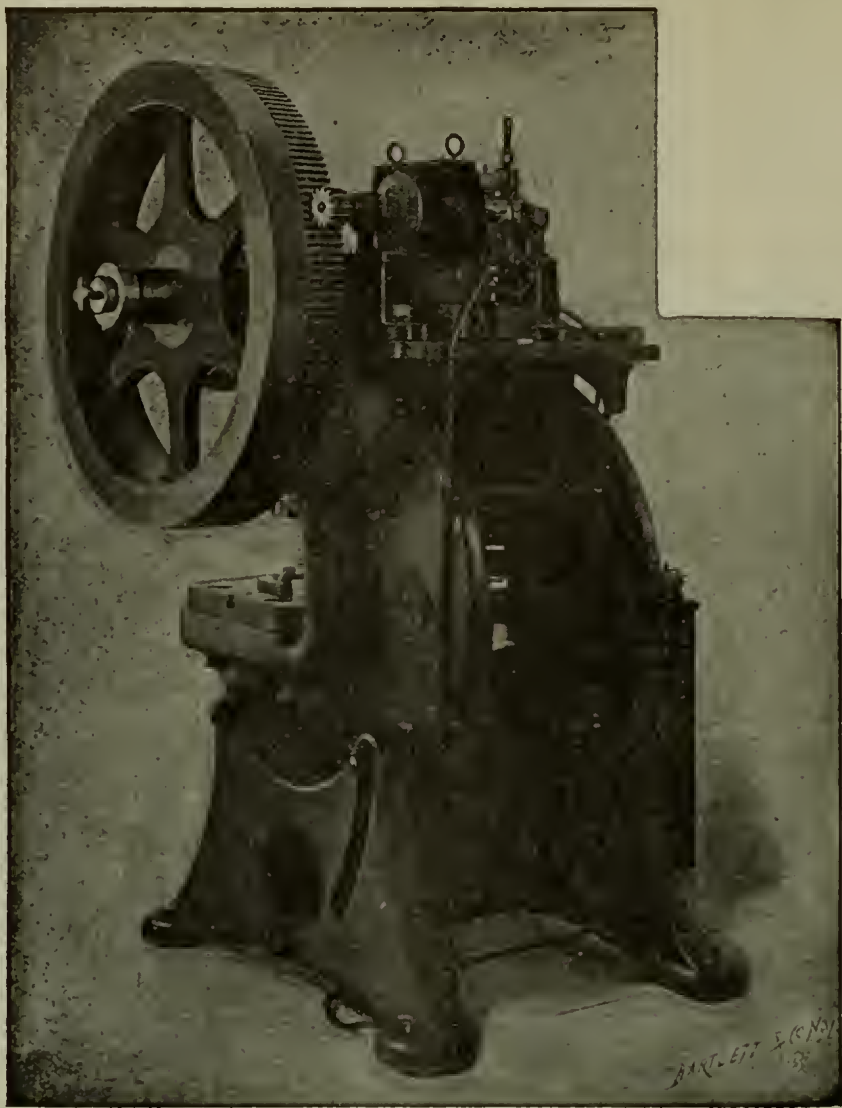
DIRECT CONNECTION VERSUS BELTING.

The question of cost is apt to bias the reasoning of experts in reference to the best means of applying power to shop machinery. The mechanical and electrical engineer whose opinions are given entirely from the dollar and cents standpoint, regarding innovations in machinery, frequently forgets the difference between the cost of inconvenience and first cost. In relation to electrical machinery the layman even is aware of the great convenience arising from the dismissal of belts and other power transmitting apparatus from shops and in their place the use of motors whose power is directly applied to the machine operating.

In the lighting of our own homes it has taken some twenty-five or more years for the general public to feel so well satisfied with the use and price of gas that they felt disposed to discard candles and oil and use the better and newer source of illumination in their place. The reason for such a change of attitude is obvious. In so familiar a case as this it is well to understand that oil illumination is cheaper than gas in the same manner that candles, if economically used, may last through a long period of semi-darkness. A man displaying an anxiety to use kerosene oil instead of dollar gas on account of the cost would be either considered a miser or too poor to indulge in what is now looked upon as a household necessity.

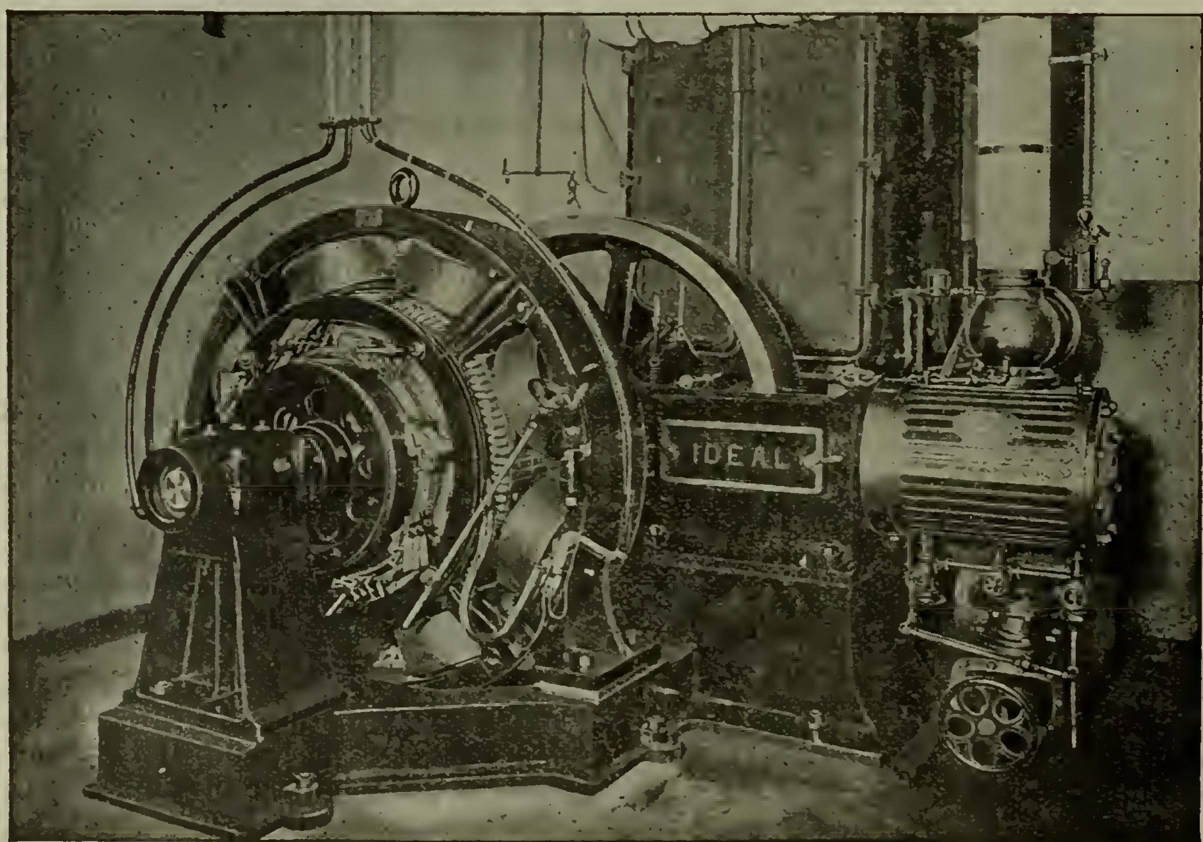
Along such lines as these it is best to review the situation as far as the use of belting or the direct connection of motors is concerned. It may be found by examination that although the original first cost may seem comparatively small the subsequent expense, though not visible by any demand made for renewal, still exists in a constant, even a persistent, waste of horse power. The erection of long lines of shafting, the employment of belts and the use of oils whose friction-reducing qualities are almost unknown, provides a means of dissipating

power that would awaken surprise if shown by dynamometer tests. In other words, unless the renting of a loft includes a supply of power, counter shafting of any description implies a steady waste of coal in the boiler during those periods when the machinery is slightly used. Practical tests have shown that in many cases the waste of power in friction in large establishments rises above fifty per cent. A one hundred horse-power plant requiring about one quarter of a ton an hour at full load will be wasting nearly one-eighth of a ton at no load. Under such circumstances during a run of eight hours one ton of coal is wasted or an average of thirty tons per month. Figuring coal at three dollars per ton about ninety dollars leaks away, in a financial sense, from the coffers of the establishment, no sign of its disappearance being left behind.



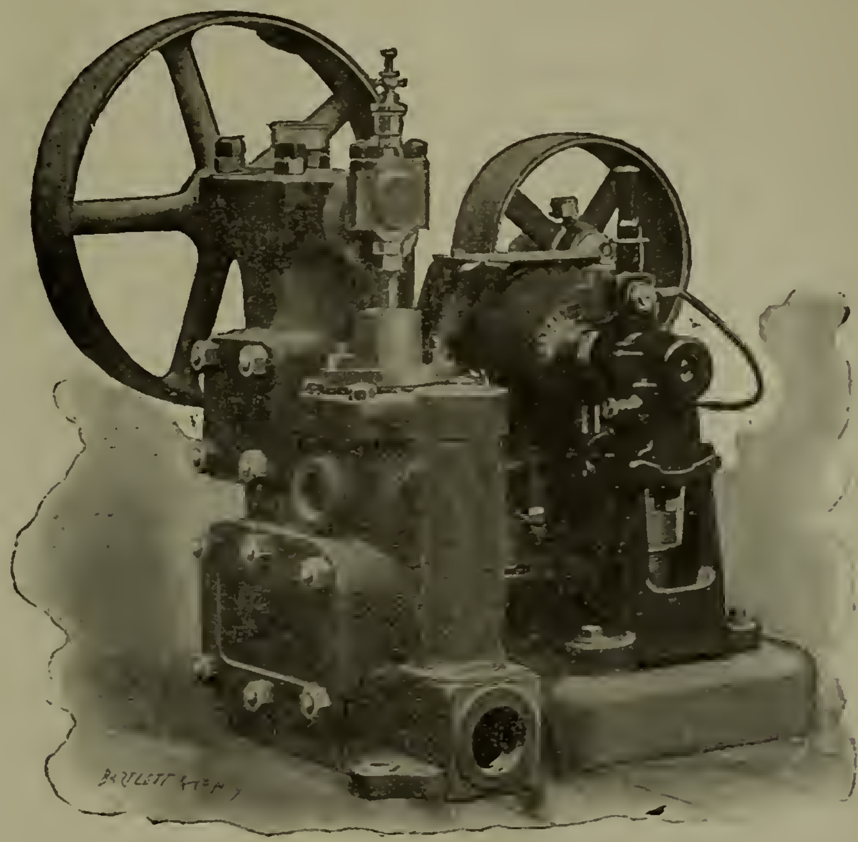
C.-W. Motor, Geared to Fly-Wheel of Punch Press.

The running of mains to which direct connected motors are attached for the driving of machinery would certainly imply first, a saving when the machines are not used, the motors then being at rest; secondly, freedom from the unsightliness and expense of erecting counter shafting on the ceiling. The first cost of motors for this



C.-W. Dynamo and Ideal Engine, Hotel Walton, Philadelphia.

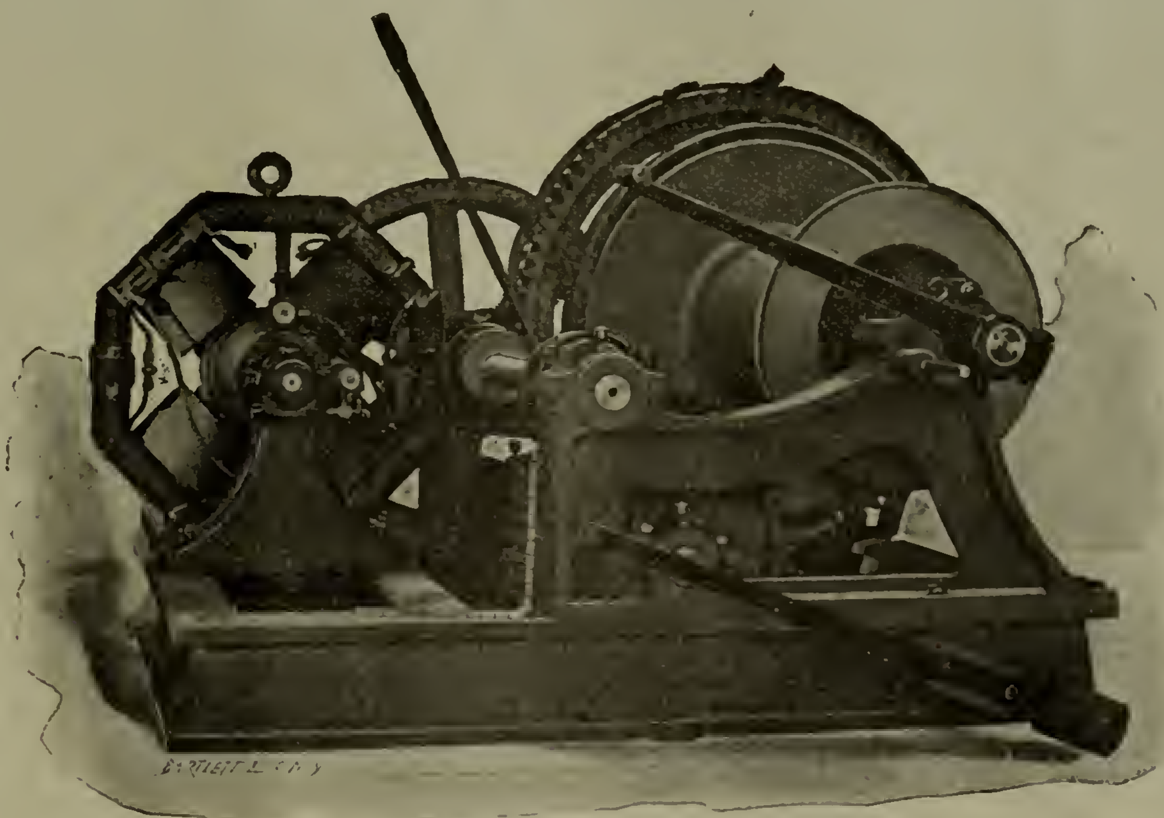
purpose is apparently greater than would seem compatible with the pocketbook of many small manufactrers, but to the owner of large establishments the question is so important a one that without doubt it should be regarded in the same sense and as carefully considered as any other business department of the concern. Not only is this fact of great consequence in a money-saving sense to manufacturers, but in office buildings, apartment houses, etc., where direct connected machinery is about to be exclusively employed.



C.-W. Motor Belted to Worthington "House Service" Pump.

ELECTRICITY FROM WIND POWER.

An electric lighting installation recently laid down at Boyle Hall, West Ardsley, is interesting, says an English paper, from the fact that wind is the only motive power employed for generating the current. There are fifty sails, set radially in a circular frame about thirty feet in diameter. A large pulley fixed on a horizontal shaft in an adjacent building drives the dynamo. The duty of this machine is to charge the storage cells, which are sufficiently large to run the 109 lights for about eight days in winter, should there be no wind for that length of time, and for more than a fortnight in summer.—Ex.



C.-W. Motor on Crook Dock Hoist.

THE EFFECT OF COMMUTATION ON THE FIELD OF DYNAMOS AND MOTORS.

Messrs. Everett and Peake, in a paper on "The Effect of Commutation on the Field of Dynamos and Motors" in the London Electrician of December 30, 1898, find, by means of an exploring coil and instantaneous contact maker, that the effect of commutation is to produce somewhat regularly recurring ripples in the curve connecting E. M. F. and position of the exploring coil, the maximum of the ripples occurring at intervals equal to the width of a coil, decreasing in magnitude as the distance from the commutated coil increases and nearly disappearing before the interpolar gap is passed. These ripples were found to be more marked with narrow than with wide brushes, which is explained by the damping effect of the adjacent short-circuited coils acting as secondaries to each other. The ripples are also more marked for heavy than for light currents and for motors than for dynamos.—Ex.

MISCELLANEOUS.

STRAY CURRENTS.

STREET RAILWAYS IN EUROPE AND AMERICA.

America has a mile of street railway to every 4,000 population, as against one mile to 45,000 people in Europe.—Ex.

CAPACITY OF AN ALUMINUM FURNACE.

In the manufacture of aluminum, one furnace at Pittsburgh, Pa., has been in continuous operation since November, 1888. This plant, with the new plant at Niagara Falls, has a capacity of more than 10,000 pounds of aluminum per day, which is nearly equal to the daily capacity of all European manufactories combined.—Ex.

THE ELECTRIC DICHARGE IN RAREFIED GAS.

Mathias Cantor (Wiedemann's Annalen, 1899, No. 2), has shown by means of the coherer (a mass of powdered metal forming a portion of an electric circuit), that the electric discharge produced through a vacum tube by a large storage battery gives off electric waves. This discharge must, therefore, be either oscillatory or intermittent, contrary to the notion which has heretofore prevailed.—Ex.

METHOD OF OBTAINING THE SPECTRUM OF REFRACTORY MINERALS.

M. A. de Gramont, a French electrician, obtains the spectrum of refractory minerals in the electric spark by mixing them with fusible salts and heating the mixture on a Bunsen burner, then passing the spark through the molten mass. The salts he uses are carbonate of lithium and sodium, which have simple spectra of their own, so that the spectra of the minerals are easily distinguished from them.—Ex.

AMOUNT OF POWER AT THE PARIS EXPOSITION.

The total amount of power estimated as necessary for the Paris Exposition is 20,000 horse power, of which 15,000 is alloted for lighting and 5,000 for motive power. Upon this assumption there is allowed a consumption of 440,000 pounds of steam per hour, or, for 205 days, at seven hours per day, a total of 613,400,000 pounds of steam for the entire period. This will require 200 tons of coal a day, and the water required for condensing purposes is estimated at more than 280,000,000 cubic feet for the whole period of the exposition.—Ex.

CONTRACTS FOR CAR LIGHTING EQUIPMENTS.

The National Electric Car Lighting Company has received orders for car lighting equipment for use on a car on one of the Russian railroads, for an application to an officer's car on the Illinois Central, for the private car of Vice-President Crocker of the Central Pacific and for eight postal cars on the Atchison, Topeka & Santa Fe. The last mentioned equipment and the one in Russia have been applied and are now running. The Atchison has a number of cars lighted by this system as has been noted in these columns.—Ex.

WIRELESS TELEPHONY.

The first practical application of the principle of the "wireless" telephone is said to have taken place with excellent results in Brussels. A short time ago a violent storm broke the wires connecting the telephone subscribers at Ixelles with the Central Telephone Office in Brussels, and it was declared that it would take about three weeks to re-establish communication. Somebody connected with the telephone service then suggested a trial of telephoning without the wires until the damage could be repaired. The suggestion was taken up, and some experiments were made which proved so successful that the inhabitants of Ixelles have since been telephoning to Brussels with as much facility as when the wires were intact.—Ex.

A CURIOUS INCIDENT.

The Street Railway Review gives an illustration of a curious occurrence in connection with one of the street railways. The line referred to is equipped with very long cars running on two trucks, one at either end. On the day in question a car was approaching the street crossing at which lines went off to the left and right respectively. After the front truck had taken the switch to the left the switch-points moved, and the truck made for the right-hand street. The electric motors on each truck did their best to get ahead, but as they were pulling in opposite directions, and the car would not stretch, they came to a standstill with the car's body just about at right angles to the original track. Of course, no damage was done.—Ex.

ELECTRO-CHEMISTRY.

Electro-chemistry, now in its infancy, offers possibilities for the future that are quite bewildering. A late suggestion by Mr. Thomas Ewen is that, by compressing sulphur dioxide and air into separate carbon tubes, dipping in sulphuric acid, the two gases—the former the familiar gas of burning sulphur—may be made to unite, forming sulphuric acid and at the same time yielding an electric current. He believes the alluring prospect of obtaining electric energy as a by-product in a chemical factory will stimulate efforts to overcome the difficulties in the way of making such a process a success.—Ex.

A NEW INDICATOR FOR ELECTRIC WAVES.

A galvanometer of medium sensitiveness is connected to a battery, a strip of silvered glass is included in the circuit and the coating of silver is scratched across so as to break the circuit. The strip is placed in moist air and the galvanometer shows a deflection. When the strip is exposed to electrical waves the galvanometer deflection is suddenly reduced to nearly zero; and when the waves cease the galvanometer deflection is quickly re-established. This effect is described by A. Neugschwender (Wiedemann's Annalen, 1899, No. 2), and the author finds that the film of moisture recovers its electrical conductivity so quickly after the cessation of the electrical waves that a telephone in circuit with the silvered strip gives the tone of the induction coil break even when the frequency of the break is very great.—Ex.

UNITED STATES COMMISSION TO THE PARIS EXPOSITION OF 1900.

Chicago Offices, April 4th, 1899.

Gentlemen.—For the benefit of the trade which you represent will you please state that all who desire to exhibit in the Paris Exposition of 1900 are requested to immediately notify this office, if they have not already done so, in order that they may be considered in the allotment of space which will soon be made. While there are many applications on file in every line of industry, it is desirable that the American Sections be not only representative of this country, but also represent the largest possible number of producers. Both our commercial interests and national pride demand that our works be entered in this most important international exposition. It is estimated that fully 60,000,000 people from every part of the globe will attend, and it will be an opportunity to greatly increase our foreign trade and to demonstrate that the United States is supreme in the arts of peace.

Respectfully,
JOHN H. M'GIBBONS,
Director of Exploitation.

Approved:
FERDINAND W. PECK,
Commissioner-General.

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CONTENTS

THE MULTIPLEX PRINTING TELEGRAPH.

Prof. Henry A. Rowland, of Johns Hopkins University, of Baltimore, Md., has invented a remarkable machine by means of which a great number of signals can be sent and received on one line in printed form. An alternating current is used which enables two distant stations to keep machines situated at these points in absolute synchronism.

We quote as follows, in order to be more exact, from the "Railroad Telegrapher:" "at each end of the line there is an alternator furnishing current for the synchronizing apparatus. Each alternating machine or dynamo has attached to its shaft a set of commutators, the number of segments which correspond to the number of messages to be sent and the current is delivered to brushes revolving around these commutators. Each machine receives half waves of the current and by cutting out the other half of each wave the local relays are operated. There is one main relay which works ten polarized relays. The currents from these relays are collected by the selecting commutators which operate the sub local relays. There is but one synchronizer for all the machines which operates a continuous current motor used for driving the entire apparatus and keeping the same in synchronism. In case the apparatus should get out of synchronism there is a telephone indicator to warn the operator who is enabled to bring the apparatus back to synchronism in a very brief time and with very little difficulty."

One of the most remarkable features of this system is the use of a synchronizing device which does not fail to operate. It is thoroughly reliable and has been in constant use for two years without failure. This apparatus has been applied to telegraph lines of the Pennsylvania Railroad Company, running between Philadelphia and Jersey City, nearly one hundred miles. The test was very satisfactory and showed much superiority over the ordinary system at present in vogue. In telegraphing between Chicago and New York, for instance, no relays would be required and it is certainly true that messages cannot be either sent or received, as in this instrument, in a printed form.

Prof. Rowland has labored very hard to perfect his system of telegraphy and as each step was perfected allowed the apparatus, when possible, to be experimented with in a most practical manner. For instance, an artificial line was constructed, representing about sixty miles of submarine cable and fifteen hundred miles of land line. Through this resistance and capacity signals were successfully sent and received.

From a purely commercial standpoint we will say that its application to private offices is an immediate possibility. An ordinary typewritist, accustomed to stenography and dictation, in the course of a month can receive and send thirty-five or forty words per minute. This simplification of telegraphic apparatus and methods is apt to cause a revolution in large business districts on account of the ease and privacy with which signals may be sent. Stock exchanges would certainly be greatly benefitted by receiving messages in this manner, the personal element being almost entirely excluded, and mistakes directly traceable to the man at the other end.

Prof. Rowland has been greatly identified with researches in magnetism and the construction of a screen whose rulings are less than one hundred thousandth of an inch apart. His electrical and optical work have brought him considerable fame and his reputation is firmly established on both continents as an able scientist and intensely practical experimenter.

GEORGE IZAMBARD.

The problem George Izambard has set out to solve is one which has excited considerable discussion within the last few months. His propisition to print newspapers by X-rays and the experiments he performed to prove the solidity of his claims merits careful attention. The practicability of his scheme has been made manifest but its commercial side has still to be investigated.

First of all the ink M. Izambard uses is made of a finely powdered metal such as bronze or copper or an ink derived from white lead or white zinc. The sensitizing solution used for the paper is a gelatino-bromide emulsion which in itself need not be handled except by professional people or large manufacturing concerns from which it may be readily obtained.

The question now arises as to whether this process could not be generally employed in publishing and business offices where a great deal of duplicating is done. For circulars and similar kinds of work such establishments would find it no greater labor to duplicate by X rays than by employing the use of familiar types of duplicating apparatus. We do not recommend the establishment of a photographic dark room in private offices, but we believe the apparatus could be so constructed and simplified that the operation of duplicating would lose much of the tatooing and general nastiness that it is now associated with. Draughtsmen and architects use a photographic process to-day for the manufacture of blue prints in their own offices, by the way.

If M. Izambard will indicate a means whereby the intermediate steps are condensed into one simple process X rays and business offices may be closely associated in the near future. At present, while admitting the possibility of printing newspapers or even books by X rays, the elements of time and expense are so much greater than those at present involved that we doubt its practicability.

ACCOMMODATIONS FOR MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

VERY visitor to the Electric Show will find his interest stimulated by the fact that his physiological and mental condition is at par. In order to assist our out-of-town friends in procuring satisfactory accommodations, we place before them for inspection some of the best hotels New York affords. There seems to be every reason to expect the convention to be unusually well attended. The general prosperity at present prevailing in business circles will be the means of allowing delegates to attend without fear of having left too many responsibilities behind. The Electrical Exhibition will also contain many new and interesting electrical features, some of which may cause great surprise to even the electrical fraternity. The following brief description is given of some of the hotels best patronized by the association members.

THE ASHLAND HOUSE.

One of the most familiar edifices to passengers from the West Shore Railroad, going east, is the Ashland Hotel, situated at the corner of 24th street and Fourth avenue. The green car line, leaving the Grand Street Ferry as well as the 42d street, passes the door. This hotel is a familiar resort to many of the delegates of the National Electric Light Association. The Ashland House possesses two things of great value to visitors, an unsurpassed kitchen and smooth running electric elevators. Its situation renders it easy of access from all places of amusement. Professor Doremus, of New York College, has invented a system of fire-proofing combustible articles, such as lace curtains, carpets, etc., which has been adopted by the Ashland House. Mr. H. H. Brockway, the proprietor, has been assured by repeated experiments that Prof. Doremus' discovery has made the room fittings practically incombustible. In this respect the Ashland House is certainly a most desirable stopping house for visitors to whom an undisturbed night's rest possesses considerable value. The electrical equipment and annunciator system of this hotel completes the sum total of conveniences at every guest's disposal. The house is conducted on the American and European plan. The Pennsylvania Railroad depot can be reached in eight minutes.

Ashland House.

THE STURTEVANT HOUSE.

Members of the National Electric Light Association will appear en masse the first week in May to attend their convention and witness the opening of the Electrical Exhibition at Madison Square Garden. William F. Bang, proprietor of the Sturtevant House, Broadway and 29th street, New York City, in speaking of the safety of his hotel, states: "The most modern electrical apparatus is employed that relates to fire alarms. The safety of guests in more than insured by the use of watchmen who patrol the building, inside and out, during the night. In case of danger great loud sounding electric gongs would awaken the guests. The employment of fire escapes, ropes, etc., entirely eliminate risk on that score. The walls of the building are subdivided every 20 feet in such a manner that the hotel is practically composed of separate buildings. Wherever there is a wall of this description there are fire-proof doors, and in this manner danger from fire is reduced to a minimum. The elevator of the Sturtevant House is absolutely fire-proof, and the employes are trained like the ancient Romans. The menu, situation and appearance of this establishment is excellent. Its central location makes it admirably suited to visitors from distant cities.

THE HOTEL VENDOME.

The Hotel Vendome, at Broadway and 41st street, New York city, is situated in a most interesting manner on one of our broadest thoroughfares. It is a largely and strongly built fire-proof building containing three hundred rooms. The menu and general accommodations are of the highest order. The most modern of hotel appliances may be found on the premises. Each room can signal individually, easy access and exit is possible, and hot and cold water baths are, as it were, at one's very door. This hotel is a great resort for visitors and business men and its reputation for good service is of the highest. The Metropolitan Opera House, Hammerstein's Victoria, the Casino and many of the best known theatres in this city are a three minutes' walk from the hotel. Central Park and cars running east, west, north

and south to reach it or places contiguous to it run day and night at the corner. The electric car service is situated in the neighborhood and visitors attending the Electric Show and National Electric Light Convention can complete their electrical experiences in a most satisfactory manner by visiting the principal points of interest such as Grant's Tomb, lower Broadway, Wall street, etc., in auto-mobiles. The rooms of the Hotel Vendome are well illuminated at night and the circulation of air is abundant. This hotel is under the constant supervision of its owner and manager, Mr. Louis L. Todd.

Hotel Vendome.

Inner Court of Park Avenue Hotel.

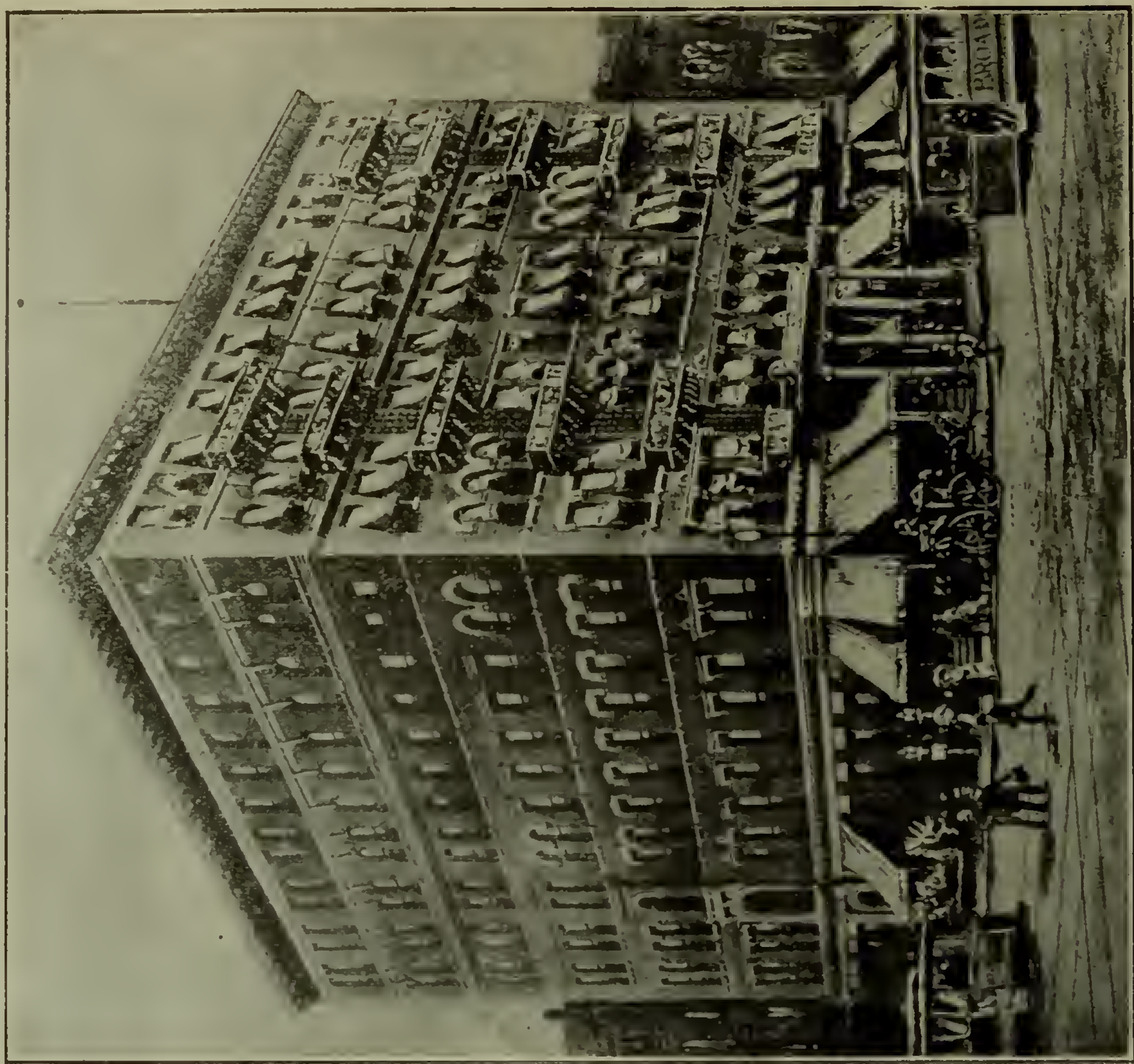
THE PARK AVENUE HOTEL.

One of New York's most famous business men, A. T. Stewart, built the Park Avenue Hotel. This absolutely fire-proof structure, situated on Park avenue, between 32d and 33d streets, away from the noise and rush of Broadway, and within easy reach of the electric cars, Grand Central Station, theatres, retail stores and principal hotels. This hotel is one of the most massive structures in the world. It is constructed along lines which render it strong beyond description. Iron, steel, mortar, stone and brick have been freely used with such effect that six more stories could be piled on top of the present edifice without a single additional support. This building fronts on three streets, rendering exit comparatively easy as the building is but seven stories high. The great halls are ten feet wide, and each floor is divided into five sections, enabling the employes to cut off any one section of the building from the others in case of fire. The five hundred rooms in the hotel are provided with up-to-date electrical appliances. The menu of this establishment is high class in every particular. The elevators carrying guests up and down are surrounded by brick walls. In addition to these are five iron stairways. A short walk from Madison Square Garden, at which the National Electric Light Association's convention, as well as the Electrical Show, will be held, will bring guests directly to the hotel.

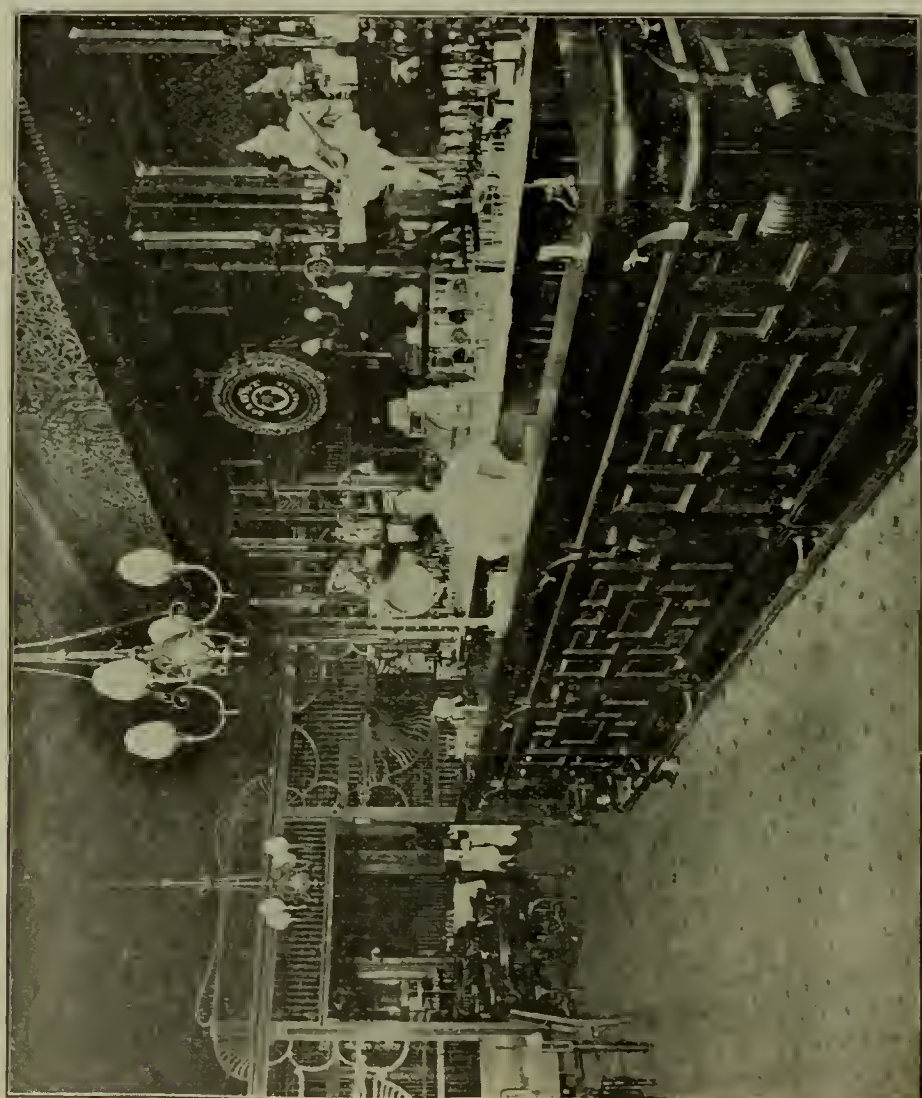
Park Avenue Hotel

THE HOTEL BARTHOLDI.

The hotel Bartholdi receives electricity from the mains of the United Electric Light & Power Company. In other respects its electrical equipment of fire alarms, telegraph, telephone and annunciator call give guests every accommodation and ready convenience. It is situated at Broadway and 23d street, and in its immediate vicinity are a variety of theatres and other places of amusement. To lovers of art the Academy of Design and the American Art Association rooms are within ready reach. Out-of-town guests, desirous of hearing the latest topical songs and jokes, will find an entertaining



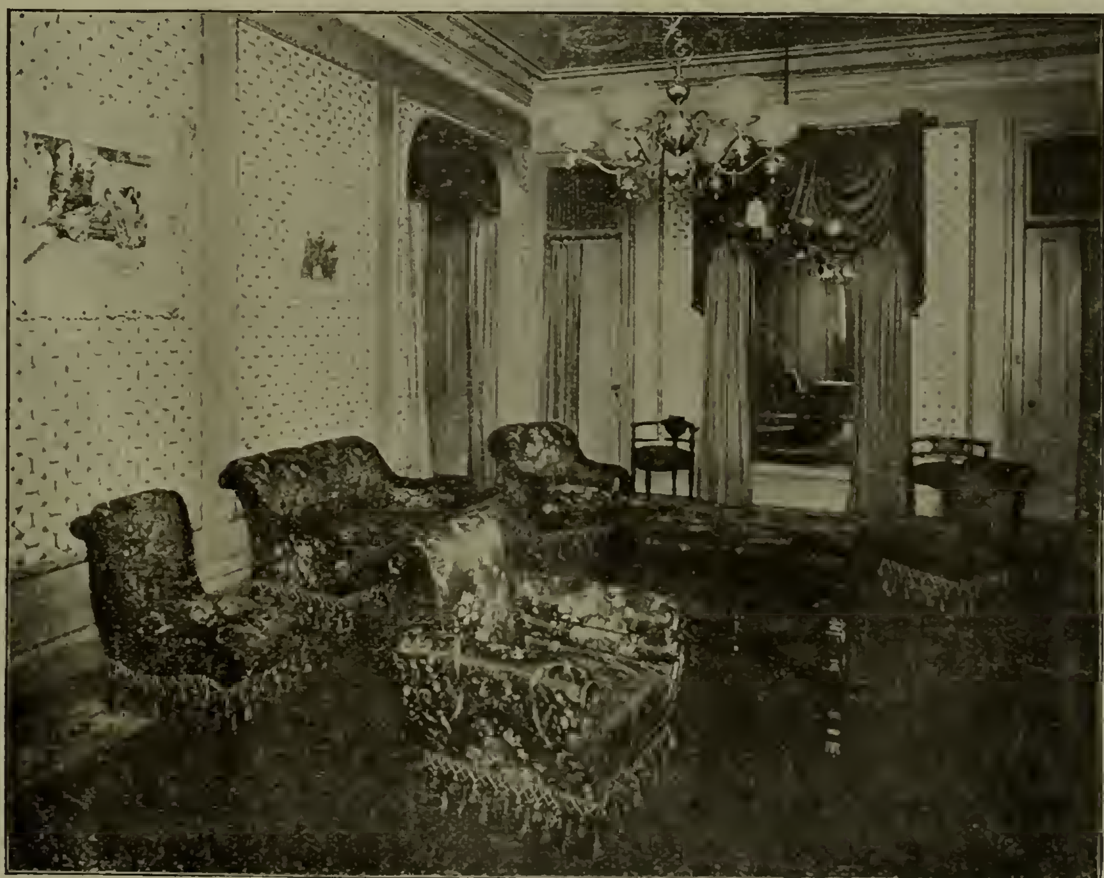
Hotel Bartholdi.



Cafe and Bar, Hotel Bartholdi.

programme at Koster & Bial's, Proctor's or Keith's. The street cars that pass the door lead to and from all railroad depots, ferries and steamboat wharfs. Central Park, adjacent to which is the Museum of Natural History and within which the Metropolitan Museum of Art containing several million dollars worth of paintings is situated, can be reached in ten minutes from the Bartholdi. The menu of the Hotel Bartholdi receives careful attention from a master in the culinary art and is pronounced by experts to be well worthy of careful consideration. The interior of the hotel is not showy but quiet and pleasing. Madison Square Park can be seen from the windows through which sunshine and air freely pass. Mr. Milton Roblee acts in the capacity of manager. His long experience in the hotel business assures every guest a most careful and considerate attention.

Lobby of the Hotel Bartholdi.



Parlor of the Hotel Bartholdi.

THE HOTEL MARLBOROUGH.

The Hotel Marlborough, situated on Broadway, occupies the entire block from 36th to 37th street, New York City. It is conducted on the American and European plan with a restaurant above criticism. This massive and interesting structure is absolutely fire-proof, and

within a minute's walk from all the principal points of interest in New York City. The Crystal Palace of the New York Herald is across the way, and cars pass the door which bring you directly to all parts of the city. At 33d street is the elevated railroad station, and a mile further up is Central Park. The hotel is supplied with all modern improvements, such as the long distance telephone and telegraph. Sleeping apartments may be secured en suite or single room. The excellent illumination, high ceilings and home-like appearance bring comfort at once to the weary traveller. The entrance of the hotel leads into a large and roomy corridor. The dining room is attended by experienced waiters and a well known orchestra plays in the dining rooms. Madison Square Garden, at which the Electrical Show will be held during the first week in May, can be reached by a walk down the most famous thoroughfare in America. The large city stores, theatres and ferries are readily reached, and a list of places worth visiting can be obtained at the clerk's desk.

Hotel Marlborough.

Fifth Avenue Hotel.

THE FIFTH AVENUE HOTEL.

The Fifth Avenue Hotel, fronting on Madison Square, is within a stone's throw of the Electrical Exhibition. It is run on the American and European plan. Meals are ob-

tainable from 6 A. M. until midnight. Rooms are supplied with electric light, signalling devices, hot and cold water, and plenty of air. The great shopping district is on all sides of it, and the Broadway, east and west side systems of transit are at its very doors. Visitors to the Electrical Exhibition and delegates to the National Electric Light convention will find this hotel most conveniently situated. In the basement will be found a most complete electric light plant, operating the elevators and supplying light throughout the building. The Fifth Avenue Hotel is identified with the growth of New York. It has entertained within its portals the future ruler of Great Britain, the Prince of Wales. Presidents, senators, congressmen, ambassadors and men of world-wide fame and reputation have partaken of its choice menu, slept in its rooms and viewed the life of this great metropolitan centre from its windows. The National Electric Light Association will simply become part of the long list of events and characters inscribed upon its books. This time-honored establishment will certainly afford every convenience to those of the electrical fraternity desirous of spending the few weeks of their visit to Greater New York with complete mental and physical satisfaction. C. N. Vilas is manager of the above hotel.

HEADQUARTERS FOR ELECTRICIANS.

The Hotel Imperial, Robert Stafford proprietor, at the corner of Broadway and 32d street, New York City, is one of the most popular hotels of Greater New York and a rendezvous for our best known electricians. As its name denotes, it is a most imposing structure, fronting on the busiest part of Broadway and in the very heart of the great amusement centre. The Imperial Hotel contains two magnificent electric light plants with a capacity of 7,000 incandescent lamps. There are four large Westinghouse and three General Electric dynamos driven by Whitehall, Ball & Wood and Woodbridge engines. The

Hotel Imperial.

Herzog Teleseme electric system for signal and call of guests has been in operation in this hotel for a number of years and it is one of its features of safety and quick and convenient dispatch.

The hotel is only a few blocks away from the Electrical Show and is near the shopping and business districts as well as within a stone's throw of all the best known theatres. The Thirty-third street "L" road station is practically across the way, and both cable and electric cars pass the door.

The building proper is built of iron, stone and fire brick throughout. The five hundred rooms in the hotel are absolutely fire-proof, and are practically isolated from the building proper, and the stairs, elevator shafts, etc., are all of iron. L. D. Smith, the old assistant in the management, will take Mr. Stimson's place as auditor, May 1st. Mr. W. H. Lee, the manager, is one of the most popular men in the hotel business. Joseph McKiernan, electrician, with a corps of assistants, attends to the electrical engineering. Invitation is extended to Central Station representatives and exhibitors at the coming Electric Show to visit the Imperial Hotel. It will be well for N. E. L. A. members and visitors to the Electric Show in May to have their names booked at once for rooms at this hotel.

THE ELECTRICAL SHOW.

The following is a partial list of the exhibitors at the coming Electrical Show:

American Engine Co., Bound Brook, N. J.; American Electric Novelty & Mfg. Co., 255 Centre street, N. Y.; American Vitrified Conduit Co., 39 Cortlandt street, N. Y.; American Electric Vehicle Co., 1545 Michigan avenue, Chicago; American Miniature & Decorative Lamp Co., 255 Centre street, N. Y.; American Circular Loom Co., Boston, Mass.; Adams-Bagnall Electric Co., Cleveland, Ohio; American Mutoscope Co., 837 Broadway, N. Y.; American Pulley Co., Philadelphia, Pa.; Ball & Wood Co., 120 Liberty street, N. Y.; Buffalo Forge Co., Buffalo, N. Y.; Boston Electro-Duct Co., Boston, Mass.; Bullock Electric Co., 220 Broadway, N. Y.; Bossert Electric Construction Co., Utica, N. Y.; Bryan Marsh Co., 136 Liberty street, N. Y.; Cling-Surface Mfg. Co., 146 Virginia street, Buffalo; Cincinnati Shaper Co., Cincinnati, Ohio; Crocker-Wheeler Electric Co., 39 Cortlandt street, N. Y.; Camp Co., H. B., Aultman, Ohio; Colliery Engr. Co., Scranton, Pa.; Corey, R. B., 26 Cortlandt street, N. Y.; Columbia Electrical & Mfg. Co., 1112 Sansom street, Philadelphia, Pa.; Dietz, Schumaker & Boye, Cincinnati, Ohio; Dixon, Jos., Crucible Co., Jersey City, N. J.; Dale Co., Thames and Greenwich streets, N. Y.; Emerson Electric Mfg. Co., St. Louis, Mo.; Estey & Saxe, 97 Fifth avenue, N. Y.; Electrical Appliance Co., Jersey City, N. J.; Electrical Engineer Inst. of Corres. Instr., 120 Liberty street, N. Y.; Forbes, W. D. & Co., Hoboken, N J.;Fayerweather & Ladew, 159 E. Houston street, N. Y.; Frink, I. P., 551 Pearl street, N. Y.; Granger, Francis, 26 Cortlandt street, N. Y.; Griffing, A. A., Iron Co., 66 Centre street, N. Y.; Gold Car Heating Co., Frankfort & Cliff streets, N. Y.; General Incandescent Arc Light Co., 33d street and 1st avenue, N. Y.; International Correspondence Schools, 14 East 17th street, N. Y.; Indiana Bicycle Co., Indianapolis, Ind.; India Rubber and Gutta-Percha Insulation Co., Glenwood, N. Y.; Kaufman & Alexandre, 1153 Broadway, N. Y.; Lamble, H. V., Rockaway, L. I.; Libbey Glass Co., Toledo., Ohio; Machado & Roller, 203 Broadway, N. Y.; McCay Engineering Co., 106 East German street, Baltimore; National Gramophone Co., 874 Broadway, N. Y.; National Meter Co., 118 Chambers street, N. Y.; New York Electric Equipment Co., 33d street and 1st avenue, N. Y.; Northern Engineering Co., 39 Cortlandt street, N. Y.; Niles Tool Works, Niles, Ohio, Northern Electrical Co., Madison, Wis.; New York Telephone Co., 18 Cortlandt street, N. Y.; Orient Electrical

Co., Youngstown, Ohio; Prindle Pump Co., 120 Liberty street, N. Y.; Paragon Fan Motor Co., Brooklyn, N. Y.; Pope Mfg. Co., Motor Carriage Department, Hartford, Conn.; Pittsburgh Reduction Co., Pittsburgh, Pa.; Rockwood Mfg. Co., Indianapolis, Ind.; Roebling, John A., Sons Co., 117 Liberty street., N. Y.; Risley-Bird Mfg. Co., 94 Fifth avenue, N. Y.; Riker Electric Motor Co., 45 York street, Brooklyn, N. Y.; Standard Steam Specialty Co., 83 Centre street, N. Y.; The Stirling Co., Chicago, Ill.; Safety Insulated Wire & Cable Co., 229 West 28th street, N. Y.; Warren-Medbury Co., Sandy Hill, N. Y.; J. P. Williams, 39 Cortlandt street, N. Y.; S. S. White, Dental Mfg. Co., Chestnut & 12th streets, Philadelphia, Pa.; Wagner Electric Mfg. Co., St. Louis, Mo; Willard & Frick, Rochester, N. Y.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

TOTAL ELECTRICAL EXPORTS FOR WEEK ENDING APRIL 11th, 1899, $34,019.00.

NEW YORK, N. Y., April 11, 1899.—The following

Ecuador—46 packages electrical material, $960.

Havre—18 packages electrical material, $818; 4 packages electrical machinery, $300.

London—46 packages electrical material, $5,764; 4 cases electrical machinery, $217.

Liverpool—1 case electros, $10.

Marseilles—21 cases electrical material, $2,289.

Milan—6 cases electrical material, $392.

Manchester—1 case electrical material, $180.

Naples—3 cases electrical material, $224.

Nice—13 cases electrical material, $12,364.

Novorossisk—1 case electros, $16.

Odessa—1 case electros, $16.

Porto Rico—8 packages electrical material, $213.

Sandwich Islands—6 packages electrical material, $75.

St. Petersburg—7 cases electrical machinery, $139; 9 packages electrical material, $668.

U. S. of Columbia—40 cases electrical material, $165; 1 package electrical material, $25.

NEW INCORPORATIONS.

Waterloo, N. Y.—Seneca Edison Co. has been incorporated by S. Dana Greene, Norman H. Becker and H. M. Francis to manufacture electricity. Capital stock $50,000.

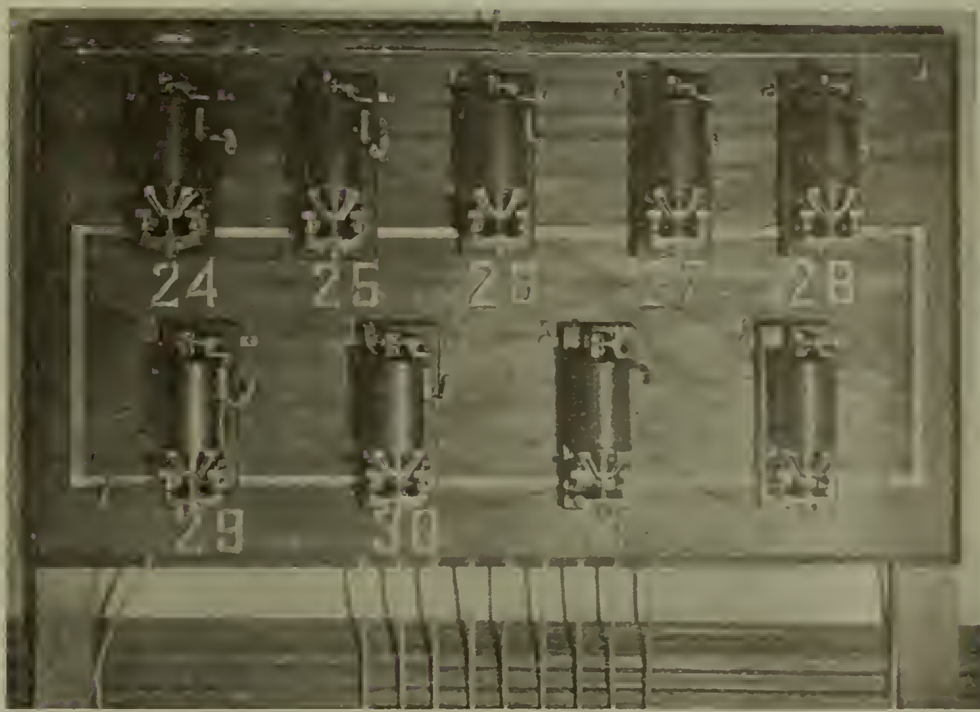
San Francisco, Cal.—Butte County Electric Power & Lighting Co. has been incorporated by S. C. Denson, O. W. Meysenberg, W. E. Palmer, H. W. Snow and T. J. Ryan for the purpose of making and selling electric lights. Capital stock $50,000.

Trenton, N. J.—The American Incandescent Light Co. has been incorporated by Charles E. Dickey, Harry A. Norton, Charles D. Burrage and Kenneth McLaren to manufacture and deal in gas and electric lamps. Capital stock $2,000.

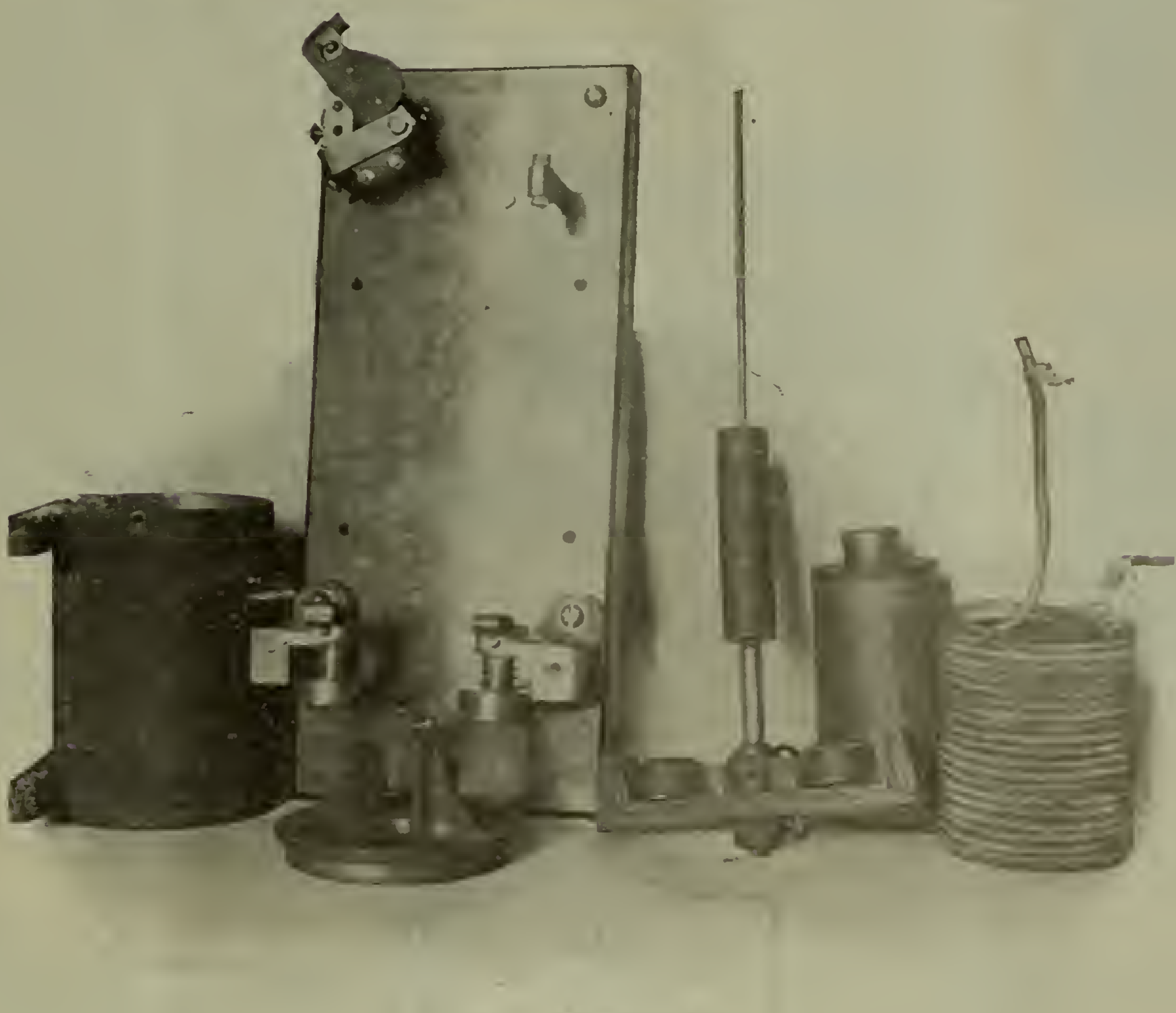
The Electrical Age.

Vol. XXIII—No. 17 NEW YORK, APRIL 29, 1899 Whole No. 624

ELECTRIC RAILWAYS.



Bank of Vault Switches.



Details of Vault Switch.

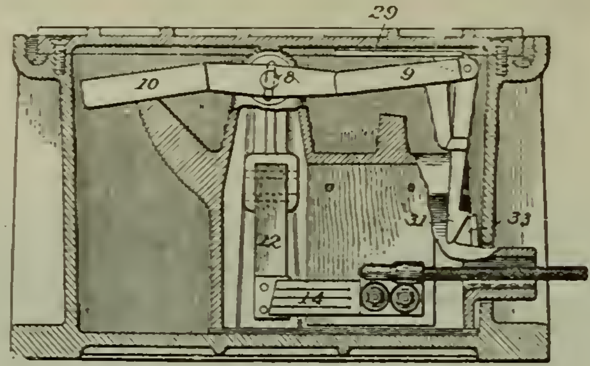
THE SAFETY THIRD RAIL ELECTRIC SYSTEM.

The objections to an underground or overhead conductor have been the cause of many experiments directed along lines which ultimately led to a solution of this interesting problem. The effect of municipal restrictions was such that within the limits of Greater New York, particularly in the more crowded section of the city, capitalists were forced to adopt an open conduit system, containing two underground conductors.

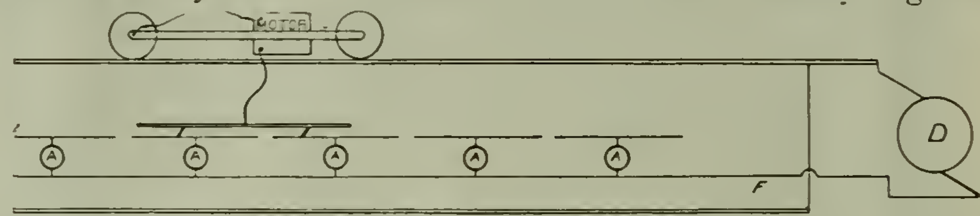
The Safety Third Rail Electric System, invented and perfected by Capt. J. McLeod Murphy, obviates the necessity for using an overhead wire or the erection of an open conduit extending along the line of track. The Safety Third Rail System, by means of an exceedingly simple appliance, calls for a road bed flush with the main street, two tracks and a middle rail and absolutely no sign or suspicion of a current except under the car itself.

In other words, the power house connection passes along with the car, the track being dead in front and behind.

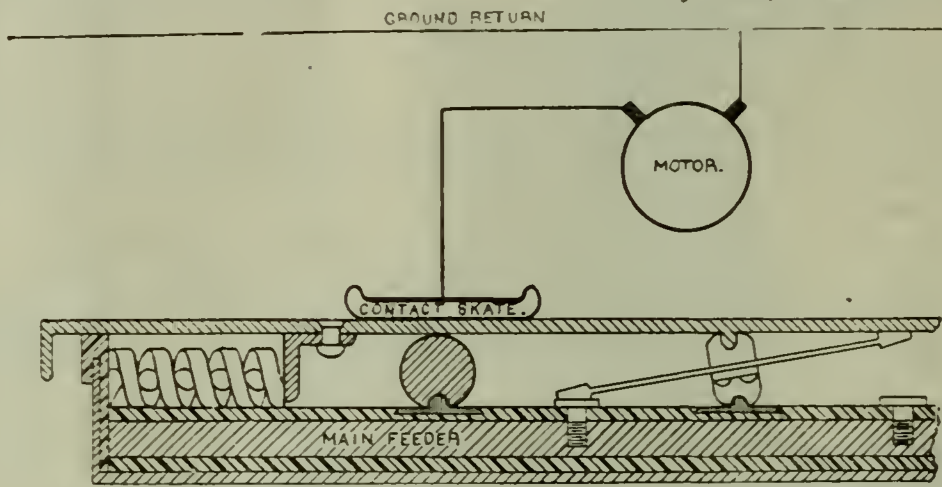
In a system of this kind the experience of hundreds of inventors has proven that success lies in the perfection of that appliance by means of which current is automatically supplied from the third rail to the car. The automatic switch which opens and closes as required comprises the essential mechanism of the system. If devised in such a manner that its reliability is unquestionable success is an inevitable consequence. If faulty in construction and complex in principle its operation cannot be relied upon and the system dependent upon it will certainly fail.



System Worked by a Magnet on the Car.



General Principle of all Sectional Conductor Systems

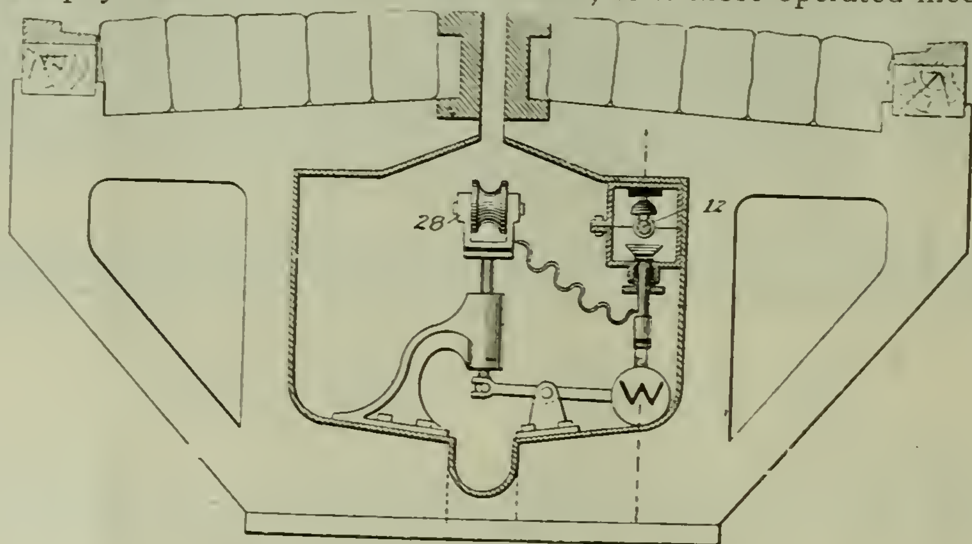


A Mechanical System Worked by the Friction of the Contact Skate.

The switch invented by Capt. Murphy overrides all objections, and repeated tests have justified the assertion that proper contact conditions make its operation inevitable. Not only is the Murphy switch remarkable on account of its absolute certainty of action, but it represents a type of construction through which current may pass freely and the circuit made and broken without arcing. The switch is therefore unique in this respect and the durability of it is thereby extended over a long period of active service. Mechanical deterioration is practically the only maintenance to which the switch is subject. Under various headings and in conjunction with appropriate illustrations the various elements of the Murphy system are presented to the reader's notice.

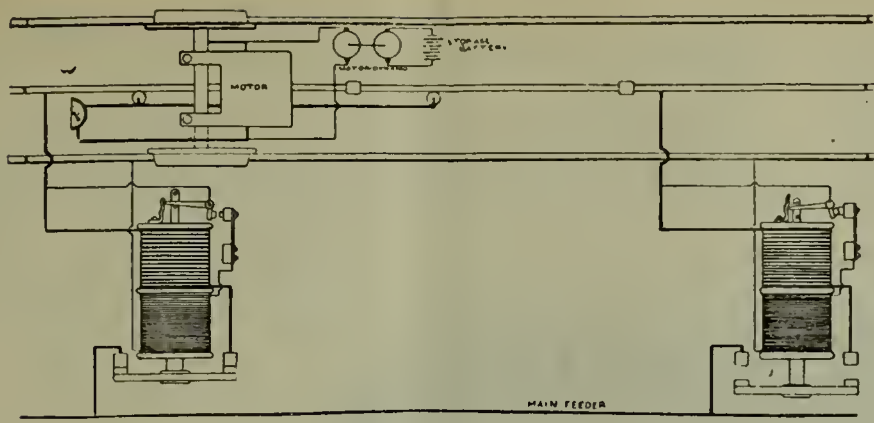
The above is merely a general resume of the subject given for the purpose of impressing the reader with the main point to be considered in the various pieces of mechanism comprising a third rail system.

In presenting the problem of a successful sectional conductor system, it will be instructive to consider some of the switching devices that others have used, for they aptly illustrate the difficulties that must be overcome. Three great classes of automatic switches have been devised, viz.: those operated mechanically by the car, those operated magnetically, and lastly those operated by electro-magnetic means. These will be taken up in order.

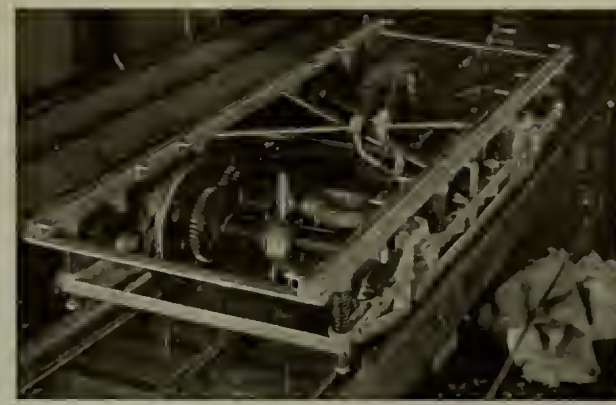


Mechanical System Requiring a Conduit.

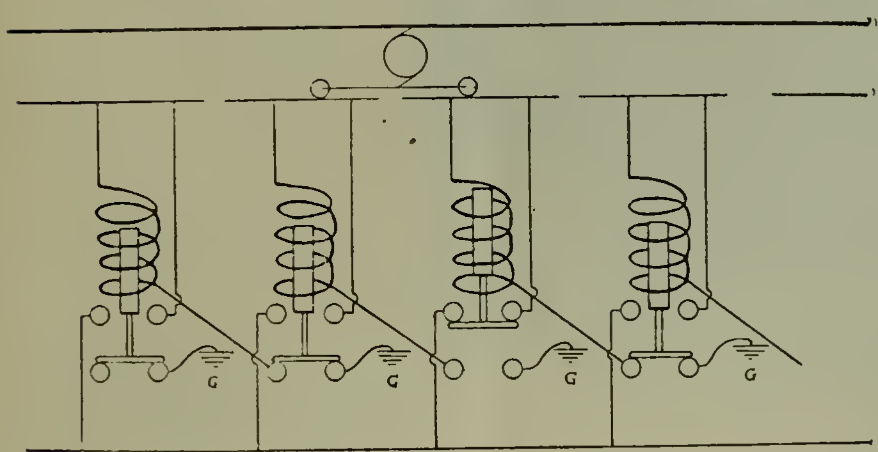
A typical mechanical system is shown in Fig. 2. A



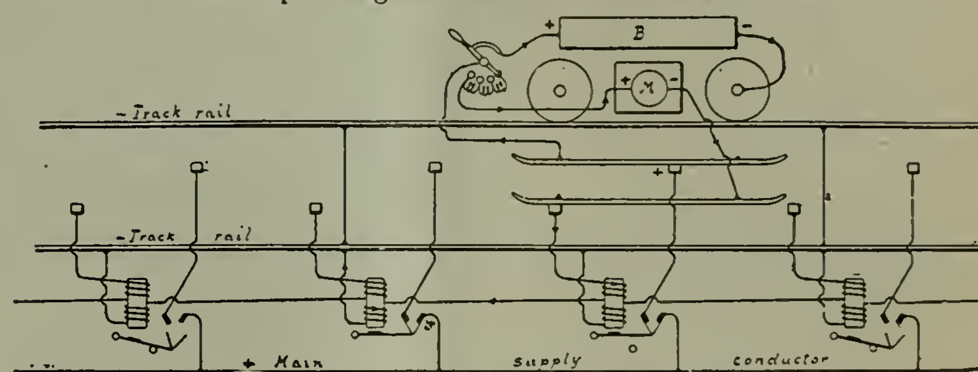
Single Connections of Murphy System, Sectional Rail



Operating a Truck in Pool of Water.

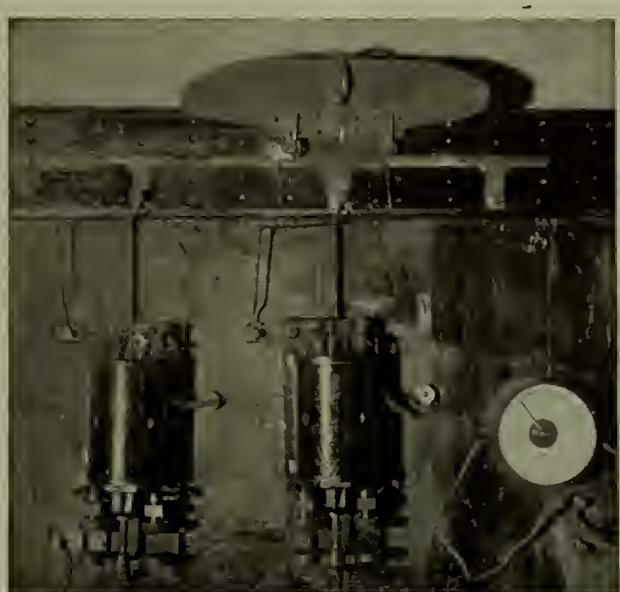


A System Which Cannot Run Backward.



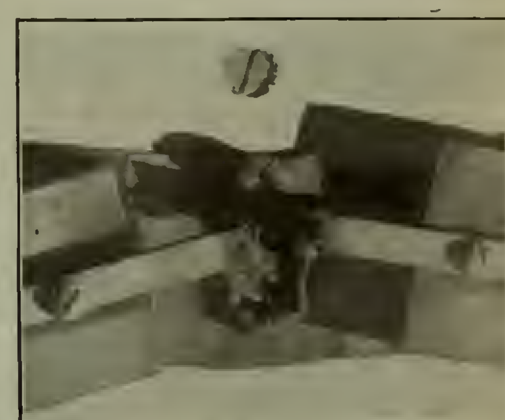
A System in Which the Car Carries 250 Cells of Battery.

Terminals Supporting an Arc.

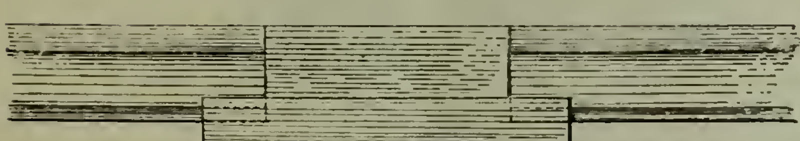


Where the Arc Occurs.

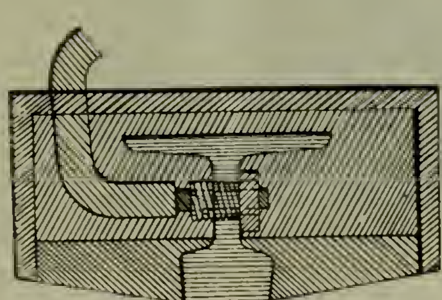
New Terminals



Damage Done by Arc.

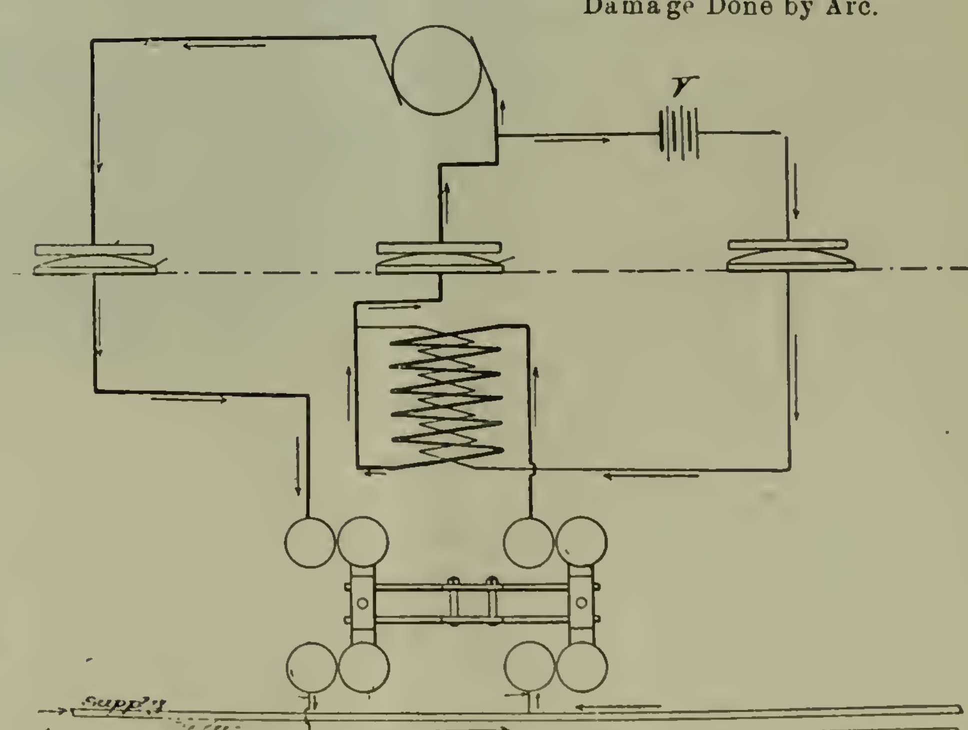


Insulation Block.



Rail Connection.

Insulation Block and Track.



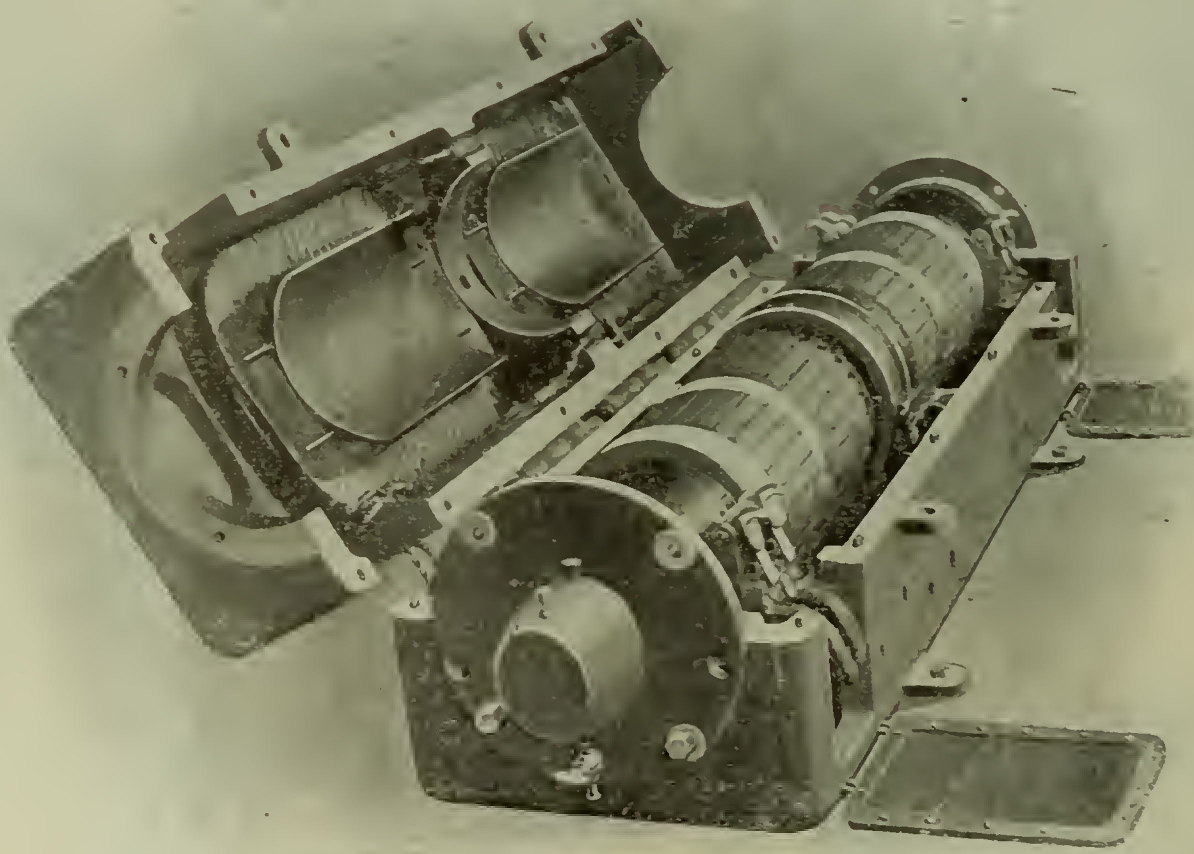
Electro-Magnetic System, Using Three Contact Skates.

skate-shaped conductor carried by the car depresses a contact wheel raising the weight W and making connection with the conductor 12. After the car has passed, the weight falls and disconnects the contact wheel from the supply conductor. This system requires a costly conduit and is more expensive than an ordinary conduit system. In Fig. 3 a sectional third rail system is shown that has been before the public quite recently. In the device shown, the friction of the collecting shoe drags the third rail forward, tilting the central lever so as to connect the rail above with the feeder below. Springs restore the rail after the car has passed.

A magnetically operated switching system is shown in Fig. 4. Contact boxes like that shown are spaced at proper intervals to supply an equal number of third rails. A heavy magnet on the front of the car acts through the man-hole cover, and lifts first the thin plate 29, thus unlocking the switch, which it then closes by tilting the plate 9. In this position the switch remains till the car is about to leave the section, when another magnet on the rear of the car acts on the armature 10 and pulls the switch open.

Motor Dynamo.

Electro-Magnetic Systems.—The Murphy system belongs to the electro-magnetic class, and, before describing it in detail, three others will be illustrated, because in this way the needs of a perfect system of this class will be forcibly presented. In an electro-magnetic system the switches are operated by electro-magnets which receive their currents from the car, or through its agency, at the proper time. A typical system is illustrated in Fig. 5. Insulated buttons are placed at proper intervals in the roadway, and long contact skates mounted under the car receive current therefrom.



Motor Dynamo Open.

The Importance of Non-Arcing Switches.—In automatic switches it is highly important that they be absolutely non-arcing. Few realize this difficulty, and the following figures will serve to show its importance. Fig. 6 illustrates a pair of solid brass terminals. Fig. 7 shows

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NEW YORK, APRIL 29, 1899.

CONTENTS

A REVIEW OF ELECTRIC RAILWAY SYSTEMS.

It is generally understood by the public that the installation of a railway system is regarded from two standpoints by capitalists. First, the practicability of the system is investigated, and secondly, the cost of the road per mile. Among the many systems of electric traction that could be put into practical operation there are two at present which, in the United States, have come into prominence. One of these is simply the overhead trolley system, a familiar sight to the citizens of Greater New York. The other, the open conduit electric road, has but recently made its appearance, and may appear to many who pay fares as merely a new form of cable road. At any rate the overhead and the underground systems in Greater New York represent an investment of millions of dollars. The rolling stock of the surface roads of Brooklyn and the rolling stock of the Metropolitan Traction Company of New York are the offspring of the same idea although crystallized in different forms.

Davenport, the famous American blacksmith and inventor, in building his first model of an electric road little thought of the vast possibilities contained within his toy mechanism. Many important problems have arisen of a purely technical character and municipal restrictions and the demands of the general public have given rise to others requiring the most careful study and consideration. In reviewing the works of recent writers on the subject of electric railways, even in the statements of those who led the vanguard in the march of progress, a denial is made from the very start of the possibility of so improving a certain system of electric railroading as to make it practically and commercially successful.

To quote from the work of two well know authorities we find the following: "As regards the three rail method of distribution it was employed with a fair degree of success, but proved inconvenient owing to the position of the bare conductor with reference to the earth. If the third rail be supported above the level of the ground on insulators it gets in the way of general traffic; if placed on the level of the tracks it still menaces, under ordinary circumstances, vehicles and foot passengers and becomes the seat of insufferable leakage at any of the voltages now generally used. Hence it is generally inapplicable."

The authors state very clearly that a third rail system for underground roads and elevated structures is particularly applicable. In fact, they believe in the isolation of such a road from all others as being necessary and conducive to its certain success. This fact is borne out by experiments made on the New Haven and Hartford road by President Clark; also on the Brooklyn Bridge of this city. But it is curious to hear mention made of the open conduit system upon which the stock and future of the Metropolitan Traction Company wholly depends. We quote again: "The slotted conduit somewhat similar to that used on cable roads has been over and over proposed and tried for sheltering the conductors, for the most part with very indifferent success. The Bentley-Knight roads in this country have now been totally abandoned (1892) after long and costly experimenting, and there is to-day no conduit road in operation in America. Abroad Siemens and Halske have met with considerable success particularly at Buda-Pesth, but how far this result is attributable to the system employed and how far to the less existing conditions of the European climate it is impossible at present to say."

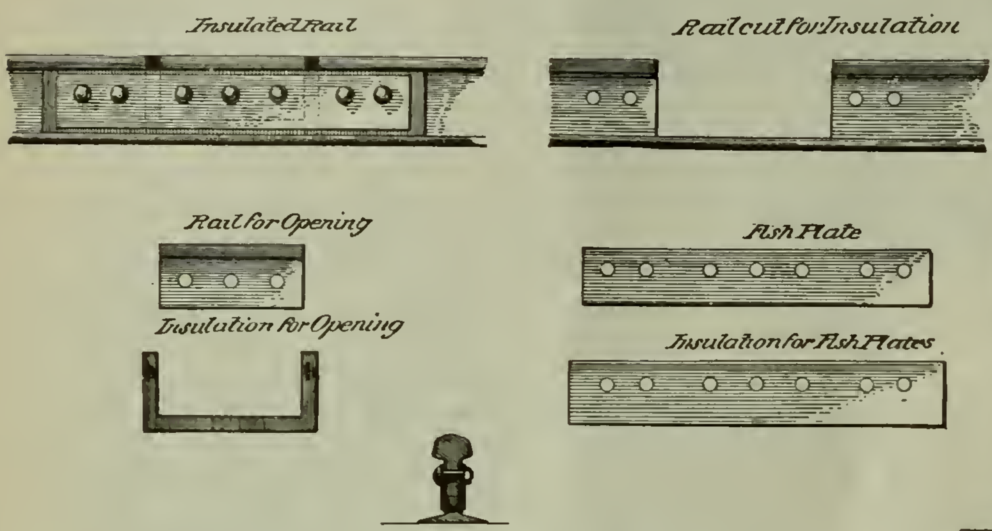
When we realize that Buda-Pesth certainly experiences severer climatic changes than ourselves, that its winters are more rigorous and its spring weather composed of considerable downfalls of snow and rain we can see that this argument is of little or no value in the face of what has been done successfully in New York. With good drainage the road is financially a success. In fact, so much so that the cables are being taken up in other roads for the purpose of introducing electricity.

A variety of closed conduit roads have had the same historical failure generally associated with the open conduit system, and at present have been so improved that from among them all one has become eminently successful. The Safety Third Rail Electric System, described in these columns, and invented by Captain J. McLeod Murphy, belongs to the class of automatic block systems operated through the automatic action of switches arranged at proper intervals along the track. At a recent test at Manhattan Beach the continued operation of this system in spite of many severe conditions to which it was subjected, including the flooding of the track with water, made it evident to visitors that the final problem had been solved in electric railroading.

It seems evident that the result obtained at this test that a third rail system controlled by automatic switches is admirably adapted to city traction purposes and would certainly continue to operate in spite of climatic conditions which would interfere with the working of an open conduit road. The heaviest fall of snow which clogs up a cable conduit and prevents the plow from making progress would not in the least interfere with the running of a Safety Third Railroad if the track were swept clean. It is pleasant to realize that at last all difficulties have been overcome in a perfectly practical manner. The overhead trolley, third rail, open conduit and Murphy Third Rail System now represent the links of a complete chain.

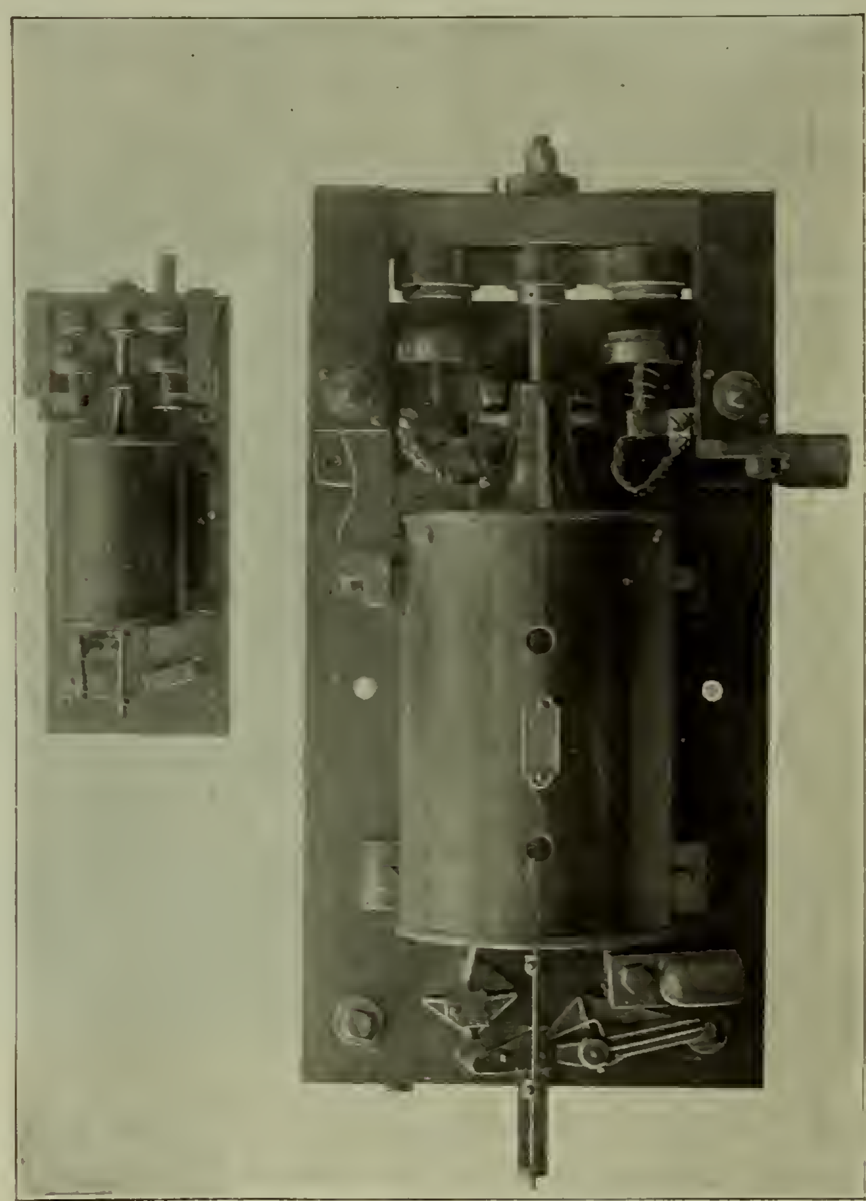
Open Duplex Car.

Car and Switch.



DETAILS OF CROSSOVER JOINT.

View of Track at Manhattan Beach.



B. & O. Switch.

them while supporting a twelve ampere arc at about fifty volts, and Fig. 8 shows their condition after the arc, which lasted about thirty seconds, had ceased. It is patent at once that the arcs of fifty to one hundred amperes at 500 volts, which automatic switches would have to handle, must be taken care of in some way. These switches have to operate several hundred times daily, and if they are compelled to handle intense arcs every time they open, their speedy destruction is certain. The show. Suppose that a switch happened to be disabled, it would not then supply current and relieve its predecessor, which would then be obliged to break the full arc. A few such operations would disable this switch, throwing the arc on the next switch back, and this continues till many switches are disabled, either leaving many live sections in the roadway or opening so large an inoperative gap that a car would be unable to coast across. Besides this objection there is further the expense of

Complete Vault Switch.

switch jaws will either be so badly burned as to preclude their making sufficient contact, or, worse still, they may be fused together, leaving a live section on the roadway.

A Makeshift Method; the Arc Blown Out by a Magnet.—The inventors of the system shown in Fig. 5 have fully realized this difficulty, and have provided a magnetic blow-out to extinguish the arc. This may be and undoubtedly is, effective, but it adds complication and cost to the system.

What Most Systems Depend Upon to Avoid Arcs.—All sectional conductor systems have a certain protection against arcs, because the car is taking current from the switch ahead before its predecessor is allowed to break and upon this principle most of them place their sole dependence. It is a broken reed to lean upon, as we shall

constantly renewing switch contacts.

Another system that has attracted considerable attention is illustrated in Fig. 9. It depends entirely upon the storage battery V to raise its switches as the car proceeds, and these batteries require to be periodically removed and charged.

A 250 Cell Storage Battery Necessary in Some Systems.—Fig. 10 illustrates still another system in which one switch depends upon the one preceding. This system uses two contact skates. A storage battery is used to operate the switches when the line current fails. This means that the battery must have the full line voltage, which, in the case of a 500 volt system, requires at least 250 cells of storage battery per car, an expensive outfit to purchase and maintain.

Fig. 11 shows another system which uses but a single third rail. It has, however, the unique disadvantage that it will not operate if it is attempted to run the car backward.

We are now in a position to show just what features a sectional conductor system must possess to be successful.

1. Its switches must automatically open circuit after the car leaves them. Any means provided by the car for this purpose is likely to fail.

2. There must be absolutely no arcing at the switch jaws.

3. The system would have but one set of third rails, and contact skates are to be avoided.

4. The switches must be simple and easy to install, and above all, reliable.

5. The auxiliary storage battery should consist of a few cells, and should not require removal from service for re-charging.

6. It should be impossible to operate the switches by leakage currents, or by any agency other than the car.

7. It must be cheap.

The Murphy system accomplishes all this, and at the same time possesses many additional advantages. Fig. 12 shows a diagram of the connections.

The car is supplied with a source of E. M. F. equal to the line voltage, which is usually 500 volts. This source of current is a motor dynamo which takes current from a few cells of storage battery and transforms it to the full line potential.

Each sectional rail is connected to a solenoidal switch which has two distinct and separate windings, one of low resistance wound with coarse wire and another of high resistance wound with fine wire. The former is normally opened and the latter is normally closed, connecting its circuit between the sectional rail and the ground.

We will assume the car to be over a rail and ready to start. The switch being open there is no connection between the feeder and the car, which therefore can receive no current. The motorman operates the controller and thereby connects the motor dynamo to the third rail and to the ground and current passes through the fine wire of the switch and causes it to operate. In response to this current the plunger rises and first makes contact between main feeder and the rail and then breaks the current of the fine wire winding. The controller is now open and current comes from the feeder through the coarse wire winding of the switch to the third rail and from thence through the car motor to ground, causing the motor to revolve and the car to move. The switch is held shut because of this current in the coarse wire winding. In this closed condition the switch will remain as long as the car is taking current from the section to which the switch is connected. When the car leaves the section, there is no longer any current passing through the switch feeding it and it falls open, first breaking the circuit between the feeder and the sectional rail and second, restoring the circuit from the sectional rail through the fine wire to earth. The switch is then ready for the next car. The car being thus started, the motor dynamo is no longer needed to operate the switches because the car is provided with two sets of shoes which are connected together and placed sufficiently far apart to span the distance from section to section. The forward shoe as it impinges on a section, subjects it to the full line potential, drawing its source of current from the rail preceding, for the main feeder has already been connected thereto in the manner just described. Once started, therefore, the car becomes independent of the motor dynamo, for it uses the power house current to operate the switches.

It will be noted that the switch remains closed until the car ceases to take current from the section it controls. It will then fall open from lack of current to hold it up and there is then no current to break and hence no arc at the switch jaws, and it is therefore a non-acting switch.

This principle is prettily illustrated by the photograph which is the subject of Fig. 13. A single switch was connected up in the usual way to a short section, and two collecting trolleys mounted on a board were arranged to take current from it. On running the collector over this improvised trackway, the collector first broke circuit at the rail section, forming the arc shown, and then, and not until then, the switch fell open and no arc occurred at its jaws. In practice, even the arc at the rail would not occur, for the collector takes current from the forward section before it releases its predecessor. The provision just explained saves the switches in case one is disabled and circuit has to be broken. The circuit is broken at the third rail and collecting brush, where no harm can be done, and the switch falls open without the slightest spark.

In order to render the car independent of the power-house current and able to pick up its switches anywhere, a motor dynamo is provided. This little machine has sufficient capacity to handle two switches and supply the lights in the car. It is shown in Fig. 14. Hence the car is never dark, even if the power-house current is shut off, an important feature in electric headlights.

One end of the motor dynamo is connected to the line and ordinarily receives current from it, acting as a motor and driving the low pressure side which charges ten small storage cells. If the line current should fail, the ends of the motor dynamo exchange functions and the high pressure side generating will supply current to operate the switches and light the car. This happens only occasionally, and hence the duty on the storage cells is very light and they require only casual attention after being once installed.

The vault switch is shown in Fig. 16. It consists of an iron-clad solenoid which thoroughly protects its coils from moisture and mechanical damage. Its solenoidal plunger, which closes circuit, falls under the action of gravity.

There is nothing to stick or catch, and the contacts should accident require them to break an arc cannot fuse together for they are of carbon. Fig. 17 shows the switch dismembered and its simplicity and small number of parts will at once be noted. Copper contacts are provided to reinforce the carbon blocks in conducting capacity, but as the carbon blocks break last any arc that may occur comes upon them and is diverted from the copper. From the wiring diagram it will be seen that the switch requires three connections. The construction of the switch is such that two of them are made by screwing the switch in place against the vault bus bars. The third connection is a light wire which is connected to an appropriate binding screw. A novice can install a new switch in three minutes.

The leakage on a sectional conductor system has been thought to be quite extensive, but this is a popular misconception. Pure water is a very good insulator against the passage of currents of any magnitude. If a car is run into a pool of muddy water, the leakage is so slight that no commercial instrument can be found to measure it. If the water be slightly salt, which is the worst possible condition that could arise in practice, the leakage would be more, but still commercially insignificent. This current would flow through the coarse coil of the switch and that coil has so few turns that fully twelve amperes, the minimum current necessary to start a car, is needed to hold the switch up. Hence the leakage current cannot hold the switch closed after the car has left the pool of salt water.

This experiment has been actually tried with the Murphy system, and the results have verified the statement just given. Fig. 18 shows the apparatus with which the experiments were tried. Provision was made to flood the track for a section with salt water and the car readily passed over this section, leaving all the vault switches down in precisely the same way as on a dry stretch of track.

Another great advantage which belongs to the Murphy system is the fact that leakage currents cannot stray

in-Chief of the Baltimore & Ohio R. R. Co., Baltimore; ahead of the car and operate the switches. It is evident that the switch in its normal condition leaves the coarse wire coil is so great that it requires the full line voltage through the fine wire bobbin. The resistance of this wire coil ti so great that it requires the full line voltage to force current enough through it to operate the switches. With many of the other electro-magnetic systems described here, the magnetic coils are of such low resistance that leakage currents can frequently enter them in sufficient volume to close the switches and charge the corresponding sections.

Another difficulty which has caused the failure of many sectional conductor systems is their inability to solve the cross over problem. At curves, crossings and other places it is very frequently the case that one or more rails will cross the track. It is evident that the skate or collecting brush on the car must drag over these rails and as the latter are well connected to ground and the former to the feeder main, the result is a short circuit. This difficulty is common to all sectional conductor systems, not even excluding the Murphy system, but in the latter has been obviated by the ingenious device shown in Fig. 19. From the drawing it will be seen that a section of rail is provided at the point where the collecting brush crosses it, which is thoroughly insulated from the main rail of which it forms a part. The mechanical construction is however so thorough that it will endure the heaviest pounding that a car wheel is likely to impress upon it. This device is of the simplest character, but has, nevertheless, been secured for the Safety Third Rail Company of New York by broad generic patents, and without using an equivalent arrangement no sectional conductor system can be operative.

A properly designed sectional conductor system is the cheapest of all systems to build. Conduit systems, which, under the most favorable conditions, cost $45,000 per mile are, of course, out of the question. In the case of the overhead trolley system, the cost of conductors is about equal to that of the sectional system, the trolley wire about balancing the third rail and switch wiring, and we then have the cost of trolley poles and overhead construction as balanced against the cost of vaults and vault switches. The difference is in favor of the sectional system. If the soil is stony this difference is greatly increased on account of the labor of setting poles. Freight charges, too, play an important part. Steel trolley poles are heavier than vault switches.

The Beauty of the Sectional Conductor System.—The relative results of a successful sectional conductor system and an overhead trolley system are in such strong contrast that, even at higher prices, the former will be preferred. Moreover, public opinion will often render the sectional conductor system the only one that can secure a franchise.

The Field for the System.—The immense commercial possibilities of successful sectional conductor systems need scarcely be discussed. The system is applicable to every mile of railway in the world. Overhead construction on steam roads has been tried and found to be a failure. The continuous live third rail is too dangerous. The sectional conductor system is the only substitute in which cost is not prohibitive. For street railway systems the overhead trolley is, of course, largely used, but much to the dissatisfaction of the public, who rightly consider the trolley poles and wires unsightly and dangerous. It needed only a public demonstration to cause the passage of an ordinance for the general burial of telegraph, telephone and electric light wires, and as soon as the sectional conductor system has demonstrated that overhead trolley wires are not necessary, they, too, will be ordered down.

The Safety Third Rail Electric Company of New York City was incorporated under the laws of the State of New York, for the purpose of purchasing the assets of The Safety Third Rail Electric Company, organized under the laws of the State of New Jersey. The latter company was the owner of the Murphy system, which has been brought to a high state of development under its auspices. The object of the new company is to exploit the system on a large commercial scale. The present company will devote itself mainly to sale of state and foreign country rights.

A section of track nearly one-half a mile in length has been installed at Manhattan Beach and equipped with the Murphy system. On April 12 a public exhibition was given to about 500, showing what the system could do. The car was run heavily loaded back and forth over the line, which contained a few slight curves and a railroad crossing, which latter was interesting because the problem to be met at such a crossing could be conveniently studied. In a small outbuilding adjoining the Oriental Hotel there was bunched eight switches connected to sections on the track. These switches were arranged in a glass case so that they could be seen by visitors, and it was interesting to note that as the car was operated over the sections which were thus controlled the switches operated with absolutely no arcs at their contacts, although they were handling currents of from 20 to 160 amperes, as shown by the station ammeter. Having thus demonstrated that the system was practically operative a number of interesting leakage tests were made. A section of the track was made live by means of propping up one of the switches and upon the section was thrown mud and water and other materials which would be likely to accumulate on a trackway in actual practice. The leakage as measured by a Weston milli-ammeter was about .2 or an ampere, or 1-100 part of the minimum current necessary to start a car. The test was exceptionally severe, partly because of the salty character of the earth thrown upon the track, the site being closely adjacent to the seashore and partly because of some tests which had been made with strong brine on that section the day before. It could easily be seen that no such accumulation of mud would be at all likely to occur in practice, because of the cleaning brushes carried by the car, and even if such a muddy section should exist in the trackway the .2 ampere would only be on for an instant while the car was travers ing that section.

At the close of the tests an elaborate luncheon was served and was followed by speechmaking. The 500 or more people present were a highly representative gathering of electric railway interests and among them may be noted:

Hugh Bonner, Chief Fire Department, 157 East 67th street, New York; E. W. Bliss, of E. W. Bliss & Co., 17 Adams street, Brooklyn; F. Bergmann, Consul General Peru, 19 Whitehall street, City; Charles Batchelor, 33 West 25th street, city; R. H. Beach, with General Electric Co., 44 Broad street, city; Brown Bros., bankers, New York City; Austin Corbin, banker, New York City; W. H. Clark, President Bergen Co. Traction Co., Philadelphia, Pa.; William Davis, Supt. Signals Central Railroad of New Jersey, Jersey City; F. S. Drake, Gen. Supt. Nassau Electric R. R. Co., Brooklyn; W. R. Fleming, Harrisburg, Pa.; M. Guggenheim, New York City; Pac Chung Hsi, Consul General China, New York City; E. A Maher, President Union Ry. Co., New York City; Emerson McMillin, Jr., of Emerson, McMillin & Co., Second Vice President Safety Third Rail Electric Co. of New York; Juan N. Navarro, New York City; N. P. Otis, Otis elevator, N. Y. City; F. S. Pearson, E. E., Met. St. Ry Co., N. Y. City; C. L. Rossiter, President Brooklyn Heights R. R. Co., Brooklyn; L. F. Requa, Vice President Safety Insulator Wire and Cable Co.; T. H. Ryan, New York City; M. G. Starrett, Met. Ry. Co., New York City; S. Uchida, Consul General Japan, New York City; H. H. Vreeland, President Met. Ry. St. Co., New York City; W. D. Young, Electrical Engineer-

Cornelius Vanderbilt, Jr., representing President Galloway, of the N. Y. Central Railway; Gen. Geo. H. Harries, President Washington and Gettysburg R. R.

EXHIBITIONS.

ELECTRICAL EXHIBITION NOTES.

Each of the Electrical exhibitions held in this city of late years has been distinguished by some special features. That of 1896 included the best public demonstration of the Roentgen rays, the transmission of power from Niagara, and the sending of a cable message around the world. The exhibition of 1896 included a complete church, lit by vacuum tubes, the application of electricity to street car traction, the first series of waxworks ever made to illustrate the history of an art, the theatrophone, and the beginning of wireless telegraphy.

The prominent feature of the 1899 exhibition will certainly be automobilism. The exhibit of electrical vehicles will be by long odds the largest and best ever seen in America, and second only to the great exhibits at Paris. In fact, in many respects, it will surpass the displays of Europe, because it will illustrate particularly the application of electricity, and because the vehicles shown will demonstrate the high perfection that the art has already reached in this country. This degree of excellence is proved by the fact that while there is no sale for European automobiles here, the manufacturers in America cannot ship machines fast enough to keep up with the demand.

This automobile exhibit bids fair to be a sensation in New York, illustrating as it will the wonderfully wide range of application, carriages and wagons of every type being shown, with many special points of novelty and originality. It has been proposed, in connection with this exhibit, to organize during the show an automobile parade, making a characteristic function of it, after the style of those given in Paris through the Bois de Boulogne. It is believed that something of this character will be arrayed while the National Electric Light Association is in session. The fact that to central station sources of supply this great new industry must look for the current which it is to use, gives peculiar interest to the situation, automobile plants being already among the largest consumers that central lighting stations have upon their list of patrons. Several thousand square feet will be occupied by the exhibits of a large number of automobile manfacturers, and in this way a convincing proof will be given to the American public that the new industry is fairly launched on its career.

A great many other important features will be brought forward for the first time and in an improved shape at the exhibition; but in view of the intense public interest manifested in wireless telegraphy the management has undertaken to organize exhibits in that line of work that will be usually instructive. It will be remembered that in 1898, mines and torpedoes were exploded in the central tank by wireless telegraph methods, and other experiments of this nature are being planned for this year.

But in order that the public may see the whole operation itself at a glance, and at the same time go away without any lurking suspicion of the genuineness of the feat, it is proposed to exhibit complete working sets of the apparatus on a long table of glass, the table itself being set up and insulated by blocks of glass, so that there will be a clear view under and around the apparatus. This table will be about 15 feet long, and messages will be sent from one end to the other, the sending signals and the response at the receiving end being heard at once. Visiting telegraphers, operators from the newspaper offices and any other spectators will be allowed to send messages or signals themselves.

The same apparatus will also be utilized in connection with the experiments for long distance work, and a series of points have been selected between which and the Garden it is proposed to exchange messages. In this manner, the public will have a better opportunity than has ever been afforded before of learning for itself the modus operandi of an invention which is stirring up the world of science no less than the outside public fully as much as the Roentgen Rays did at the time of their discovery.

Several valuable Government exhibits have been secured, and these will be grouped and attractively displayed. They include apparatus from the Army and Navy, the Signal Corps and the Weather Bureau, and will embrace also not a few interesting electrical relics of the late unpleasantness with Spain.

A special department will also be devoted to electrotherapathy, the rapidly widening science of the application of electricity to medicine and surgery, in connection with which a great deal of elaborate apparatus has already been promised. It is the special aim and intention, in connection with this exhibit, to enable the public to learn for itself how far the science of electricity has been utilized in the cure and prevention of diseases. The utmost care is being taken to treat the subject on strictly scientific lines, and a committee of eminent specialists has been organized, whose names alone are a sufficient guarantee for the excellence of the work in this department.

Another special section will illustrate the great strides made of late years in the application of electricity to dentistry. Here, again, the pervading relationship of the central station to the later branches of electricity will be emphasized, it being a fact that more and more of the practitioners who employ electricity in their work depend upon the power plants for their supply of current, with the intervention of motors and storage batteries.

A number of spectacular exhibits are also being laid out and elaborated by a committtee at whose head is Mr. Luther Stieringer, whose work is well known in connection with the electric exhibits at Chicago, Atlanta, Omaha, etc. This expert has also taken in hand the lighting of the Garden and will produce some entirely new effects, not only beautiful in themselves, but instructive as to the manner in which light should be used for the harmonious illumination of large spaces. A great many of the exhibitors are preparing features of extreme novelty and interest, to which attention will be called as soon as it is proper to do so.

It is a happy coincidence that this electrical exhibition in New York will be in progress at the same time that the electrical exhibition opens at Como, Italy, to celebrate the centennial of the momentous discovery of the electric battery by Volta. The Italian exhibition opens on May 15th, and it is proposed, therefore, to hold a special celebration at the Garden on Saturday, May 13th, from which fraternal congratulations can be sent by cable. The New York Electrical Society under whose auspices the exhibition of 1898 was given so brilliantly, has undertaken to organize the exercises of this function, and will rally to its aid on the occasion the assistance of other local and national bodies naturally interested in the matter, inviting also, the co-operation of the Italian officials and societies. President Dunn and Secretary Guy are already at work on this matter, which commends itself generally to all who recognize how great is the debt which is owed to the famous Italian from whose work, it may be said, practical modern electricity dates.

Last year the basement was devoted almost wholly to exhibits of engines and boilers and apparatus of that class. Although this was very successful, a great many of the exhibitors desired to be on the main floor. This has been accomplished in the present exhibition by General Manager Nathan, and the basement will thus be available for a series of very interesting exhibits of a special nature, each of which will constitute a separate

entertainment, and all of which will be free to the public.

There will be an electric theatre of scenic models, the theatrophone, an electrical Cave of the Winds, an electric Grotto, an exhibit of the uses of electricity under water, and several other features of equal attractiveness. Such of the space as may not have been used in this way will be thrown open to inventors and patentees, who have meritorious inventions which they wish to introduce to the public, and for which they desire to secure capital for exploitation. All likely to be interested in this opportunity are requested to communicate at once with Mr. Nathan at Madison Square Garden, who will arrange to provide them with a reasonable amount of space for their apparatus, and to assist them in every way to make an attractive demonstration at a small cost. It is believed that many worthy ideas and devices linger in obscurity for want of such an opportunity as this, and the experiment will be given a liberal trial, in order to see what it may bring forth of value and importance.

PERSONAL.

WILLIAM ROCHE.

William Roche, 259 Greenwich street, New York city, manufacturers of the well-known "New Standard" dry battery, has secured the whole building at No. 42 Vesey street, near Church, which will be fitted up with all the latest and improved appliances for the manufacture of dry batteries. Mr. Roche will occupy this building on or about the first of May and will be pleased to see his friends at his new quarters.

They will no longer be required to climb up three flights of stairs as Mr. Roche's department will be on the first floor. The building has an excellent elevator service and is equipped with electric light and power.

Mr. Roche is one of the original dry battery manufacturers of this country, having been connected with that industry for the past nine years. He manufactured the "Exeter" dry battery for the E. S. Greeley & Company,

William Roche.

this battery being selected as the best out of two hundred exhibits by a board of expert electrical engineers selected by President Cleveland, during the World's Fair at Chicago in 1893. It will be remembered that this was the battery which was used in connection with the famous golden "Victor" key with which President Cleveland opened the exposition. For some years Mr. Roche manufactured the "Mesco" dry battery for the Manhattan Electrical Supply Co., but in October, 1897, he resigned his position with that company and began the manufacture of the "New Standard" dry battery which has surpassed all his previous efforts in that line.

This battery has been introduced in the United States Navy and is used both for land and sea work. It has, by its merits, received the favorable recognition of the heads of several European navies which will probably be followed by its introduction in the service.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

Total Amount of Electrical Exports for Week Ending April 18, 1899, $46,151.00.

New York, N. Y., April 18, 1899. The following exports of electrical material, etc., are from the port of New York for the week ending this date:

Antwerp.—25 packages electrical material, $926.

Argentine Republic.—15 packages electrical material, $385; 14 cases electrical machinery, $1,208.

Africa.—1 case electrical material, $5.

British Australia.—6 packages electrical material, $52.

Berlin.—10 packages electrical material, $1,102.

Brazil.—109 packages electrical material, $3,421.

British West Indies.—5 packages electrical material, $254.

British Possessions in Africa.—232 packages electrical material, $20,935.

British Honduras.—1 package electrical material, $37.

British East Indies.—19 cases electrical material, $422.

China.—7 cases electrical material, $105.

Cuba.—21 packages electrical material, $1,240.

Hamburg.—90 cases electrical material, $7,081.

Hull.—2 cases electrical material, $150.

Leeds.—2 cases electrical machinery, $35.

Lyons.—3 boxes electrical material, $100.

Liverpool.—20 packages electrical material, $941; 2 packages electrical machinery, $57.

Mexico.—210 packages electrical material, $2,967.

Manchester.—9 packages electrical material, $430.

Marseilles.—3 cases electrical material, $203.

Porto Rico.—27 cases electrical material, $895.

Stettin.—4 cases electrical material, $2,386.

Santo Domingo.—13 packages electrical material, $209.

Trieste.—5 cases electrical material, $192.

U. S. of Colombia.—3 cases electrical machinery, $35.

Venezuela.—19 packages electrical material, $378.

NEW INCORPORATIONS.

Trenton, N. J.—The New York Electric Brake and Coupler Co. has been organized to manufacture electric brakes and couplers of all kinds. Capital stock, $1,000,000.

New York, N. Y.—The American Electroscope Co., incorporated by J. J. Alexandre, Isaac Alexandre and A. B. Louis. Capital stock, $5,000.

Philadelphia, Pa.—The American Electric Manufacturing Co. has been incorporated to manufacture all kinds of electric motors, etc. Capital stock, $1,000,000.

Petaluma, Cal.—Petaluma Gas and Electric Co., incorporated by Galen Burdell, M. A. Burdell, James B. Burdell and others. Capital stock, $300,000.

Little Rock, Ark.—The Fish Electrical Co., incorporated with Charles E. Rosenbaum, president; Jno. E. Osborne, vice-president, and Henry H. Schmuck, secretary-treasurer. Capital stock, $5,000.

Richmond, Va.—The T. Tower Blinford Electric Maunfacturing Co., nicorporated with P. H. Mayo, presi-

dent; George A. Tower, vice-president; Julian Blinford, secretary, and George M. Reid, treasurer. Capital stock to be not less than $30,000, not more than $100,000.

Bluefield, W. Va.—The East River Electric Co. has been incorporated for the manufacture of electric dynamos, etc.

Chicago, Ill.—Chicago Electric Vehicle Co., incorporated by Edward L. Brewster, Samuel Insull and Wm. G. Beale. Capital stock, $2,000,000.

Roseville, Ohio.—International Vehicle Co., incorporated by George W. W. Walker, S. P. Zehrung, George W. Owen, L. S. Kildow and G. H. Bodine; telephone line Coshocton and New Lexington. Capital stock, $500.

Montgomery, Ala.—Montgomery Water Power and Electrical Co., incorporated by J. S. Pinckard, president; J. C. Haas, vice-president, and McD. Cain, secretary-treasurer; to furnish light, heat and power to the city.

San Francisco, Cal.—Butte County Electric Power and Lighting Co., incorporated by S. C. Denson, W. E. Palmer, T. J. Ryan and others. Capital stock, $500,000.

Dover, Dela.—American Electric Manufacturing and Power Co., incorporated by Henry E. Cain, Wm. M. Baldwin and Howard L. Mendenhall; manufacture motor vehicles to be propelled by air, electricity, gas, etc. Capital stock, $1,000,000.

TELEPHONE CALLS.

Chetopa, Kan.—The Indian Telephone Co., incorporated by R. W. Blue, J. H. Arter and S. E. Arter. Capital stock, $10,000

New York, N. Y.—People's Telephone Co has been incorporated under the laws of West Virginia by A. Milford Hall, Oscar F. Shaw and others; telephone lines in all states and territories. Capital stock, $500,000.

Mattoon, Ill.—Mattoon Telephone Co. has certified to an increase in capital stock from $10,000 to $25,000.

Lebanon, Mo.—The Ozark Telephone Co., incorporated by William C. Faubion, Daniel H. Haffner, John R. Lyell and others. Capital stock, $6,000.

Alexandria, Minn.—Park Region Telephone Exchange Co., incorporated by Geo. S. C. Campbell, Nelson L. Page and others. Capital stock, $10,000.

Butler, Ohio.—Ohio Telephone Construction Co., incorporated by J. H. Neer, W. J. McCullough, L. P. Neer, A. Lanehart and W. T. Hissong. Capital stock, $10,000.

Shelby, Ohio.—People's Telephone Co., incorporated by A. R. Warner, W. W. Skiles, G. M. Skiles, B. F. Long and Elmer Mansfield. Capital stock, $25,000.

POSSIBLE INSTALLATIONS.

Hyattsville, Md.—The City and Suburban Railway Co. will grant a plant for transforming electric current from alternating to direct.

Holly Springs, Miss.—An electric light plant will be established.

Covington, Ga.—The Mayor may be addressed concerning erection of electric light plant.

Hendersonville, N. C.—C. F. Toms contemplates the establishment of an electric light plant.

Christiansburg, Va.—James Rigby & Sons will issue bonds for the completion and operation of their electric light plant.

STREET RAILWAY NEWS.

Muskegon, Mich.—The Grand Rapids, Grand Haven and Muskegon Electric Railroad has been granted right of way for a new suburban electric railroad.

JOTTINGS.

The Edison Decorative and Miniature Lamp Department, of Harrison, N. J., state that they need only a few hours' notice from persons desiring to rent electric signs for the coming Electrical Exposition. They also rent miniature lamps and receptacles.

Mr. Andrew Riker, president and electrical expert of the Riker Electric Motor Co., of Brooklyn, was on Wall street, April 22d, with his newly-built electric cab, attracting great attention in the country's financial centre. The cab proper is in the centre of the vehicle and has extensions, back and front, to hold the forty-eight storage batteries furnishing the current. The driver sits up in front like his brethren of the equine driven vehicle. This cab made the run from the new Hoffman House to Wall street in twenty-five minutes. After a few finishing touches it will be shipped to Paris. The Riker Company state that they have more orders on hand than they can take care of with their present capacity and arrangements are now under way to fix out extensive works.

Montauk Multiphase Cable Company, 100 Broadway, New York city, have recently opened an office in Boston, Mass., Room 1, Brazer Building, 27-29 State street, where the various electrical adaptations of the Montauk Multiphase cable are shown upon individual boards and sections of the dangerous parts of buildings and how they are wired for detecting fires are also graphically illustrated.

The Montauk Company's business field is rapidly widening and many installations are now being made in various parts of the country. The recent disastrous fires in New York city and Boston have created a demand for the cable as being the only reliable device known for giving timely warning of dangerous heat or flame, allowing ample time for the suppression of the fire and escape from danger.

The Sprague Electric Company, 20 Broad street, New York city, have issued a pamphlet entitled, "Electric Power. The Lundell Motor," which reflects the highest credit upon their advertising department. This pamphlet describes the Lundell motor, giving the various details of construction and the applications to which it is put. We quote the envoi of the pamphlet as a sample of the Sprague Company's high standard in pamphlet literature.

"Electricity, the great power behind all things, from which all forces emanate; sound, heat, light, gravity, magnetism, even life itself; what magic in its very name. Unknowable except by its effects, imponderable, invisible, mysterious; mighty as Jove himself or weak as the tiniest babe; pervading all space and all creation, yet amenable to man's slightest whim and harnessed by him to his bidding. What wonders has it not already wrought, and what may not future generations see as the further manifestations of its marvelous power? By it space is annihilated, and intelligence and speech are conveyed hundreds of miles in an instant of time. By it we are lighted and warmed; by it our factories and machines are operated, our vehicles and means of transportation are moved and we are carried on our way. By it in a thousand ways we are helped and life made easier. Great is the power of electricity."

The Electrical Age.

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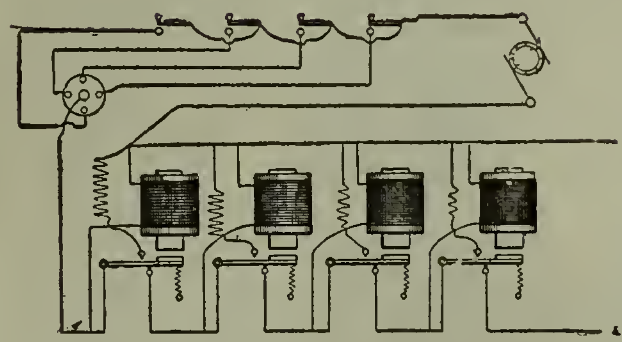
THE TELEGRAPH.

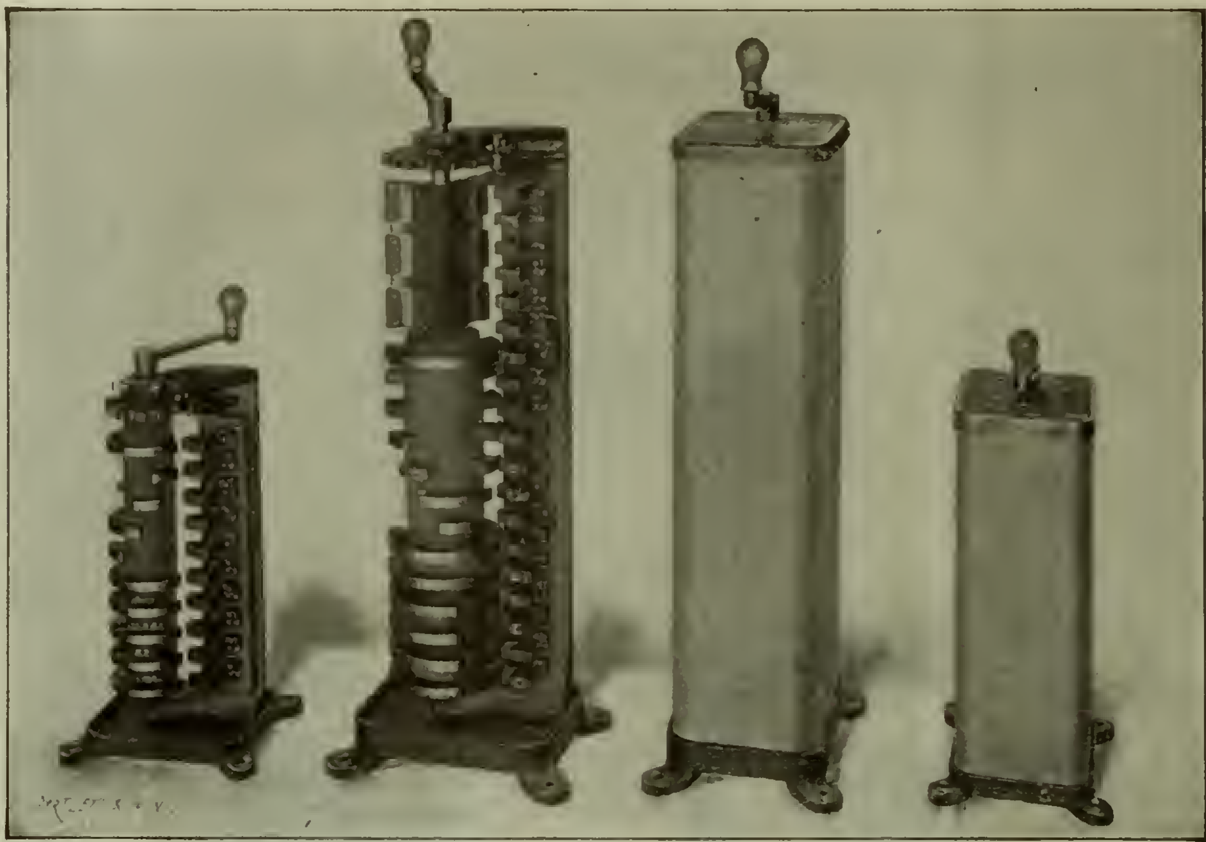


Details of Connection.

SETTING TYPE BY ELECTRICITY.

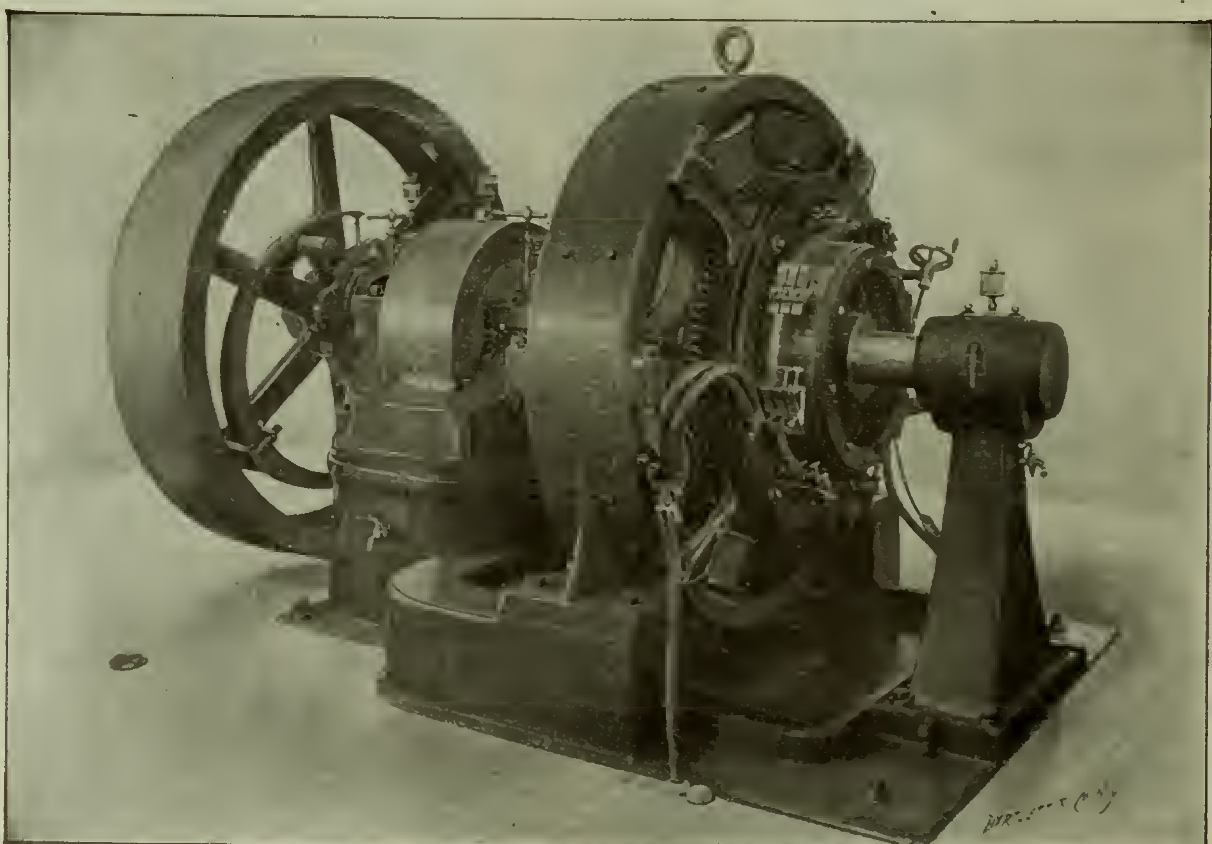
When Benjamin Franklin, with a kite and string, drew down electricity from the clouds, he did not imagine it would ever be introduced into the composing room, typesetting machines not having been at that time invented. Another printer, however, has found a way in which to utilize this subtle agent in the composing room, and his apparatus, when connected with the typesetting machine, seems destined to accomplish results in this direction. The diagram shown herewith illustrates the apparatus, patented by John S. Thompson, of Chicago, an expert linotype operator-machinist. It consists of a number of electro--magnets connected in parallel, one magnet being assigned to each key or lever of the machine keyboard. These magnates are constructed so as to require successively smaller electric currents to energize them, and they also require successively greater periods of time for their energization. Magnets wound with successively smaller wire possess these characteristics. · The sending machine is connected with the receiving machine by but one circuit, the depression of the different keys of the sending keyboard developing in the circuit currents of different strengths. If the current so sent over the circuit be insufficient to energize the first and and most quickly acting magnets, it will traverse without affecting them, and, energizing the magnet adapted to it, cause it to attract the key lever associated with it, at the same time opening the circuit at a point immediately beyond itself, and thus cut out the slower magnets before they have time to act. The sending keyboard may either be a typesetting machine or merely a facsimile of its keyboard, and if desirable, two or a dozen or more machines connected with the sending station, all on a single circuit. Thus Associated Press dispatches could be set up in type simultaneously in various cities by one man operating a keyboard in Washington or any other point. Special dispatches and syndicate matter could in like manner be set in type in the offices of corresponding newspapers instead of telegraphing or sending the copy otherwise. If that class of typesetting machines which assemble the type in a continuous line, the justification being subsequently done, were used,

the matter of differing measures of newspapers would cut no figure; nor, with that or any other style of typesetting machine, would the fact that the various newspapers use different fonts in their offices, for with a fat nonpareil, a normal minion and a lean brevier, for instance, the same matter could be set in varying fonts in the same measure.



C-W Controllers, 60-Ampere and 150-Ampere, Covered and Open

Again, if that style of typesetting machines were used which causes, by the depression of the keys, perforations to be made in a continuous strip of paper, this paper being then put into a secondary machine, the matter there being cast into type automatically, the operation becomes still more simplified, there being little more mechanism in



C-W Dynamo on McIntosh & Seymour Engine at Ampere.

these keyboards than in an ordinary typewriter, and the likelihood of its getting out of order at a critical time and thus causing delay, reduced to a minimum. This contingency, in any case, could be provided for by having two or more machines in each office equipped with Mr. Thompson's apparatus, which would in no way interfere with their being used in the ordinary way, and when a breakdown occurs in the receiving machine it could be "shunted" and another thrown into circuit instantly.

This invention is applicable also to a variety of other uses, and when applied to the typewriter will undoubtedly cause a revolution in the method of transmitting telegraphic messages. In party-line telephony, signaling, annunciators and like devices it will find a field of great usefulness. A. Miller Belfield, a patent attorney and electrical expert, aided Mr. Thompson materially in developing his invention, which is being patented in the principal foreign countries of the world.—Inland Printer.

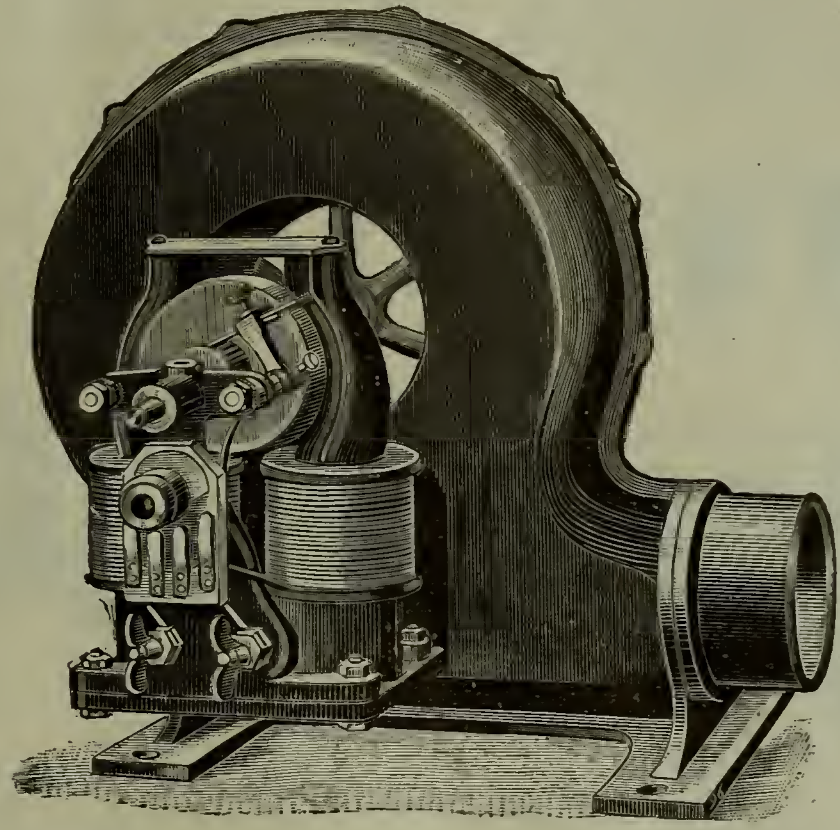
ELECTRIC LIGHT AND POWER.

SOME POINTERS ON DYNAMO ELECTRIC MACHINERY.

Probably one of the most overwhelming proofs of the reduced form and limited space occupied by electrical ma-

chinery and its controlling devices is shown by methods now in vogue of governing and operating dynamo electric machinery. The experience of amateur contractors engaged in the erecting of small lighting plants has been painful in many respects on account of the unharmoniousness of certain parts of the plant. Dynamos with regulating rheostats, unwieldly switches, with commutators of shaky construction and insufficient carrying capacity are still fresh in the memories of many contractors. In many respects this unsuitability of parts belongs to a past era in the history of electrical engineering. The direct connected plant, self contained, of minimum weight and highest efficiency and the motor governed by a controller and doing its work without attention or care, are permanent factors of to-day's work. Inconveniences that certainly made the study of electricity at one time mean the study of many mysteries exist no more and simple, practical, well designed and properly associated parts comprise the sum and and substance of modern American machinery.

The controllers, shown in illustration, for 60 and 150 amperes, shown covered and open, are a source of the greatest convenience to those employing large motors for any purpose whatsoever. The handle gradually turned throws into circuit field, resistance, armature, etc., in the same manner that those used on trolley cars enable the motorman to govern the current and speed. The dynamo direct connected with MacIntosh & Seymour engine represents the complete avoidance of those disturbing elements to which older machines were heir to. Both dynamo and engine exemplify that complete adaptability of part to part by means of which electric light plants have become perfectly automatic and highly efficient. The regulation of both dynamo and engine is such that atten-

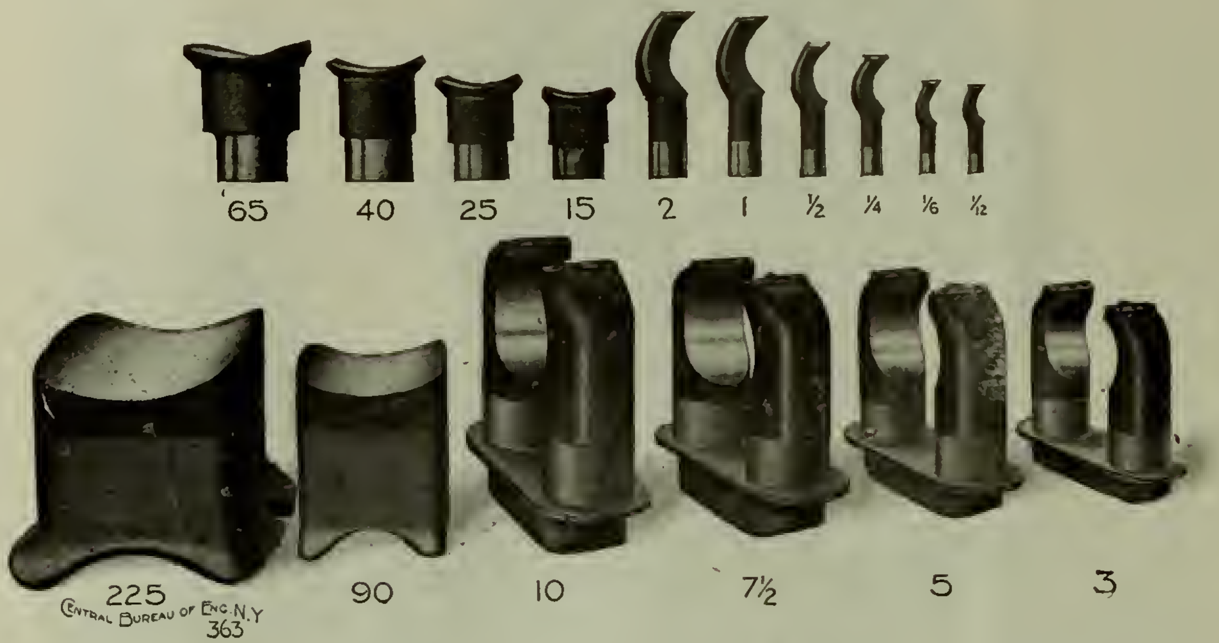


C.-W. Motor Connected to a Small Sturtevant Blower.

C.-W. Motor, With Counter-Shaft Through Base of Pedestals.

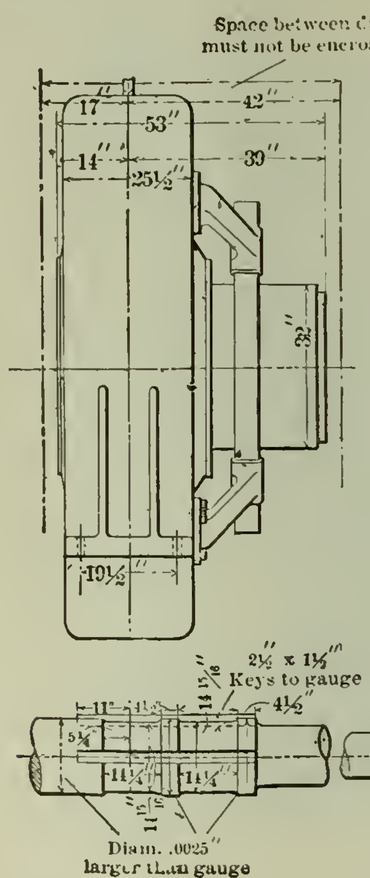
tion is reduced to a minimum and the proper proportioning of field, armature winding, brushes, commutator, etc., relieve the engineer of all responsibility other than a momentary inspection each day.

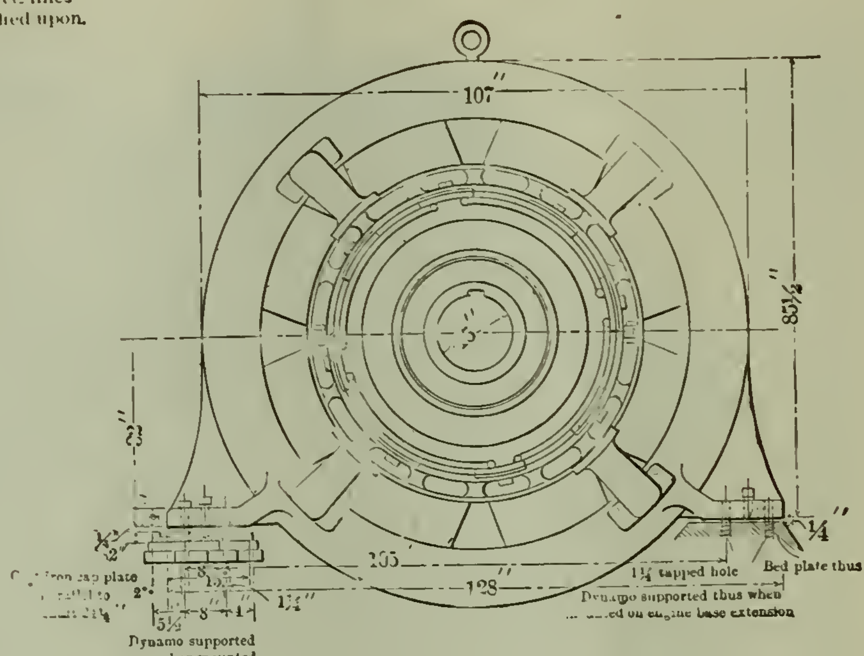
Motors have also passed through their stages of evolution and in developing, so to speak, display all those types of life. For heavy machine work as well as the lightest dental or surgical operation the motor performs its functions with reliability and satisfaction. In connection with ventilating machines and for a huge variety of other purposes motors are most generally applied. Many branches of trade have been improved by the motor. There are more engines sold, more boilers, more ventilating machinery, more glass for lamps, more copper, more cotton and silk, more shellac, than ever before, while rubber in a variety of forms appears on the market as part and parcel of electrical engineering.



Poles, Separate, for Belt-Type Machines.

as these, as the profession improved, sprang larger and heavier types, more in keeping with the time and its demands. Without question the performance of the dynamo as a factor of modern civilization is thoroughly assured. Although it may undergo modifications in the future, they will only be those which tend to reduce the size and enlarge the capacity of the generators. As far as weight is concerned the Edison "Jumbo" dynamo and a multipolar generator of the same capacity testify to the improvement in the art of building and designing. The absence of a regulating box to which an assistant clings until lamps are not to be turned on or off any more, or until the wee hours of the morning allow him to sink into peaceful slumber, although voltages may rise or fall, this at least proves that modern science has overcome all objections and produced the most nearly perfect machine conveivable.





DIMENSIONS SIZE 280 D.
TOTAL WEIGHT, 43,500 LBS.
ARMATURE WEIGHT, 10.000 LBS.
CROCKER-WHEELER ELECTRIC CO., AMPERE, N. J.

FIG. 164

In the final illustrations are shown two types of frames; the first representing those used for belt type machines on the one-twelfth horse-power to large and heavier sizes. In the line sketch is given the general dimensions of a generator suited to direct connection. The largest of our dynamo and motor constructing concerns all began by placing upon the market light electrical machinery such as small fan motors, switches, sockets, etc. From such

It is stated that in response to the petition sent by the Dover (England), Corporation to the Trinity House requesting that all lightships shall be connected with the shore by means of wireless telegraphy, a reply has been received. The Trinity House state that experiments are still being conducted, and that the Corporation's suggestion will be considered in due course.—Ex.

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CONTENTS:

A LOW WATT LAMP.

It has been interesting to note the steps of progress in the construction of incandescent lamps. Founded upon principles that are sound and substantial, the manufacture of filaments has become a science. From a vast chaos of possibilities a few definite and valuable features have been selected. They have been combined together for the purpose of constituting a finished lamp. In part this effort point, wich is to-day the guiding star of intelligent inventors.

How shall these be enumerated without calling forth a stern criticism? The opinion that the incandescent lamp is a commercial success is true. It has created a field for itself and become in many respects indispensable. The comfort and satisfaction its use engenders is a matter of common experience. Why, then, is it not popular in the home? If food and light are essential to domestic happiness ,it would be consistent to choose the best, at least of light and drive away the hampering shadows. The expenses of a home are such in many cases that the introduction of the electric light would not interfere seriously and increase them. The reason does not exist entirely here, but in a parallel channel. Gas at present costs 65 cents a thousand cubic feet in New York City; a five-foot burner will give sixteen candle-power for two hundred hours. The electric light would involve an expense of from one and a half to two dollars for the same amount of light. Unaccustomed as the majority of house owners are to the electric light, its absence is not felt in the home; but its introduction and subsequent removal would probably create a change of sentiment regarding it.

Its loss would be felt, and the difference between it and the disagreeable features of other illuminants become strikingly evident.

The home will receive the incandescent lamp when competition brings it to the door—when power becomes cheapened and allows this great and final distribution to occur; or when the energy at present consumed in a lamp is cut down to one-half.

The matter rests between these two probabilities—the production of power on a much more economical basis, or the use of lamps giving sixteen candle-power with a consumption of twenty-five watts.

RAILROADS.

There is a common belief in vogue that the wealth of Crœsus was a mere mark in comparison with the gigantic fortunes accumulated by the presidents of railroads.

The title of president bears its weight of responsibility, even though the glitter and pomp of its wear is a constant delusion to the idle mind.

In the year 1895 of the month of June, more than one hundred and fifty railways have passed into the hands of receivers. The one owning the greatest length of track was the Atchison, Topeka & Santa Fe, whose possessions extended over 4,438 miles.

In consequence of the increasing depression in business circles since then it is likely that many other concerns have joined the ranks of these unfortunates and swelled their number beyond two hundred. It may be of consequence to investors in electric roads to discover whether this unwholesome reflection upon the condition of steam roads in this country is due to an overwhelming competition, a reduction in passenger or freight traffic, or the increasing spread of trolley systems in, around and between towns and cities that otherwise depended upon locomotive traction.

The old adage is well illustrated in the ultimate behavior of many of these roads of smaller capacities that "In unity there is strength," by the unification of groups of them into larger and larger companies of greater reach and better financial standing.

The Pennsylvania Railroad has an annual gross revenue exceeding $60,000,000, which approximates a return of $22,000 a mile; the New York Central & Hudson River touching the mark at $40,000,000 gross annual revenue and $17,000 gross revenue per mile of line.

It is frequently believed that syndicates form for the purpose of imposing upon the public, but it may be believed that the formation of such is sometimes due to the irresistible pressure of circumstances. It is either a coalescence or bankruptcy. It may likewise be believed that the condition of electric roads is that of seeming prosperity, in the light of these facts, and speaks well for their introduction and maintenance by the people.

Like the numberless concerns transacting business and leading ephemeral lives, it may be said that steam roads differ from these only in magnitude, and consequently follow the same law in the pitiless struggle for existence. Their histories are more prolonged because they are bigger, but it seems that only those already in the field can persist, and even they are apt to be swept away with the rest by the strong tide of adversity.

TEMPERATURE OF THE ELECTRIC ARC.

To measure an all-consuming heat is a great scientific achievement. Of all great sources of heat perhaps the sun and the electric arc are best known. The sun is so hot, so far beyond our wildest guess, that its temperature is completely unknown. Prof. Paschen considers 5,130 deg. C. the nearest approach to the correct value. In Fahrenheit degrees this is equivalent to 9,266 degrees, a state of incandescence below our expectations.

Helmholz believes a contraction of the sun from its

primitive nebulous volume to its present size would give rise to an increase of temperature of 28 millions of degres, centigrade. Thus it is seen that we have to deal with suggestive estimates which imply conditions natural or constrained, and which in themselves but lead to further inquiry. The heat of the arc is as great a problem as that of the sun. Experiments made by Fizeau and Foucault enabled them to arrive at the conclusion that the intensity of the light produced with respect to the sun was expressed by the ratio of 385 : 1.000. The temperatures are thus compared in a crude manner. It would seem from these results that a powerful arc light produces a degree of heat which varies from one-quarter to one-particles of carbon are instantly volatilized, thus showing a heat of thousands of degres, Fahrenheit.
sixth of that existing at the sun. Diamonds, graphite and N. Y.

PERSONAL.

JOSEPH MUIR, M. D.

Dr. Joseph Muir, editor of electro-therapeutics of The Electrical Age, has been appointed laryngologist to St. Marks Hospital, New York City.

TRANSMISSION OF POWER.

A LONG POWER TRANSMISSION PLANT.

An account of what is stated to be the longest electric power transmission plant in operation is given in a recent number of "Engineering News." The generating station is situated at San Bernardino, where there is ample water supply with an available head of 700 feet. Pelton wheels are used, those at present installed being capable developing 4,000 horse-power, and it is proposed to increase this later on to 6,000 horse-power. The electric arrangements comprise three-phase generators and step-up transformers at the generating station. The former generate the current at 750 volts, which is then transformed by the latter to 3,300 volts for transmission over the line to Los Angeles, 80 miles distant. The conductors consist of six No. 1 copper wires, arranged with two three-wire circuits, and supported on poles. At Los Angeles step-down transformers reduce the potential to 2,200 volts, at which the current is distributed to a sub-station in the heart of the city.

A new element has been added to automobilism in Paris, as may be seen by the following, taken from the regulations for the circulation of automobiles in that city. "The approach of an automobile must, if necessary, be signalled by means of a trumpet." This regulation must must certainly appeal to the lovers of that instrument in Paris but, we confess that we prefer the perhaps not so musical(?) but undoubtedly more serviceable electric gong to the nerve racking and tympanum splitting trumpet, especially in the hands of the cabbies, whose musical education has, as a rule, generally been neglected.

THE TELEGRAPH.

DETAILS OF THE PROPOSED PACIFIC CABLE.

The cable itself is to be 7,000 miles long, is to touch at Hawaii and the Carolines, and connect the Southern Ladrones, being thence extended to Manila. The weight of the deep-sea cable is to be 28 tons per mile. A sixteenth part of the actual distance of the necessary connection will be allowed in excess, in order to make up for unevenness of the sea bed. The cost is reckoned at $1,000.00 per mile, and as soon as Congress has given its consent to the slight concessions still demanded, the company is ready to commence work. The starting point, according to the company's plans, will be Monterey in California, and the last point the town of Manila on the Island of Luzon. Two years will probably be spent on the completion and laying of the cable, but the survey of the route across the Pacific to Manila will probably be begun immediately. The longest section of the proposed cable would be that from San Francisco to Hawaii, amounting to 2,098 English miles. From Hawaii to Wake Island is 2,040 miles; from Wake Island to Guam, 1,290 miles; from Guam to Manila, 1,520 miles.

ELECTRIC POWER FOR PORTABLE MACHINE TOOLS.

To most minds, portability in the case of a machine tool carries with it the suggestion of relatively small size, and a 48-inch slotting machine, for example, would not ordinarily be thought of as a tool of the portable type. The advent of electricity as a motive power, however, has brought some of its striking results into this field as well as into others of perhaps better-known character, and has given to some of the heavier machine shop equipments a flexibility of application which has widely extended their sphere of usefulness and has correspondingly simplified operations of hitherto awkward nature. The possibility, through electric driving, of bringing the tool to the work instead of the work to the tool has, indeed, led to a degree of economy in the handling of material which, in one of the large engineering workshops, is the immediately striking feature of the place and at once commands attention. An overhead electric traveling crane picks up a heavy slotting, or shaping, machine, or drill press, or other tool of required kind, carries it the length of the shop, if need be, to the work in hand, and as promptly takes it away after its mission has been accomplished, to operate upon some other piece of work, or to make room for some other tool. That portion of the shop floor commanded by the crane is one huge work table, slotted and grooved in all directions for temporary bolting down the tools, and the equipment in its entirety and the methods of handling it afford a splendid object lesson of evolution in shop practice. No time is lost in carrying the heavy piece of work from tool to tool to be adjusted and fastened for each separate one; it is left in its originally alloted place, to be operated upon by each tool in turn, or, preferably, by several tools at once, as is often possible, with a degree of ease, rapidity and precision which invariably is impressive.

—From Cassier's Magazine for May.

A correspondent of the London "Daily Mail" writes an

interesting letter in refuting the claim that Dr. Oliver Lodge is the father of wireless telegraphy. In the "Scientific American" of February 22, 1879, Professor Loomis, who was then carrying on experiments in aerial telegraphy in West Virginia, did his talking with his assistant, 20 miles away, by telephone, the connection being aerial only. According to the "Athenaeum" for 1854, Dr. Franklin made experiments in 1748, in conveying telegraphic messages without the aid of connecting wires, and with the same success as Professor Loomis. In 1845 Professor Morse transmitted intelligence in the same way across the Susquehanna River. James Lindsay, as long ago as 1856, demonstrated at one of the London docks the practicability of wireless telegraphy. With regard to Dr. Lodge and Signor Marconi, we can therefore say with absolute truth, "that other men laboured, and ye have entered into their labors," and that neither is the father of the system of signalling through space.

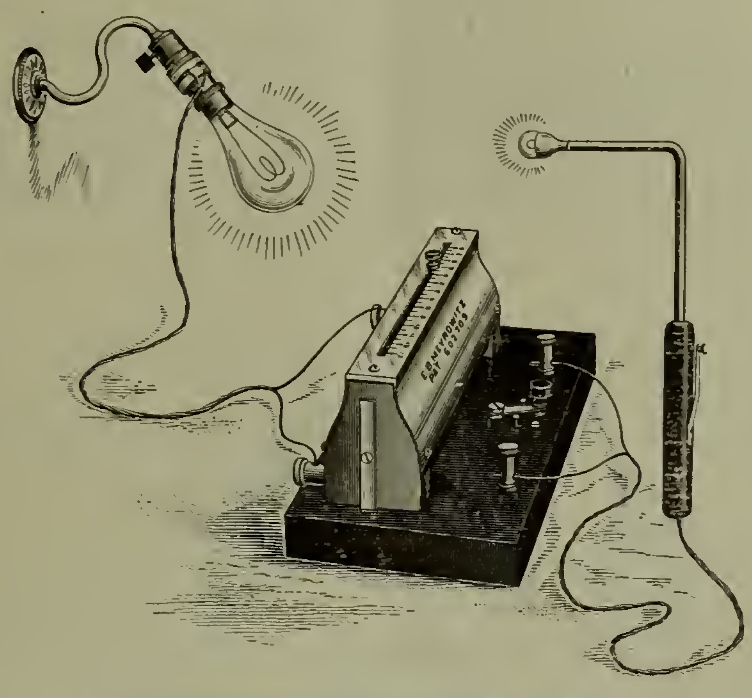
GERMAN TELEPHONE SERVICE.

Consul Schumann writes from Mainz, February 28, 1899: The telephone service of this country is a public institution controlled and managed by the Department for Posts and Telegraphs. The rates are certainly very low, the charge for a local telephone being $38.55 per annum, including the rental of the instrument. The service, however, is lacking in enterprise. I applied on February 20 to have a telephone placed in my residence, and was told that the connection could not possibly be made before May or June, as they did not string wires in winter.

ELECTRO-THERAPEUTICS.

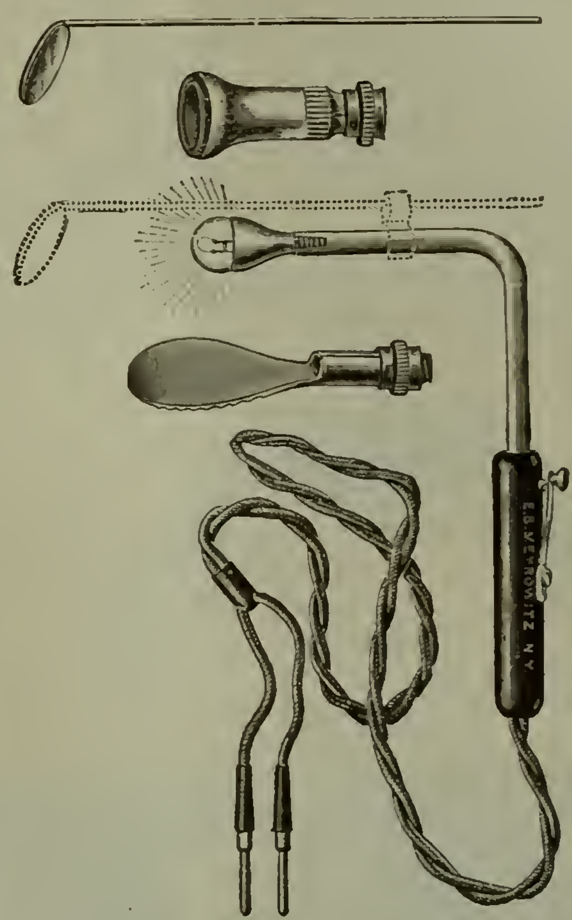
ELECTRICITY IN MEDICAL PRACTISE.

The increasing use of the electric current by the medical profession throughout the country,—more particularly in hospitals and sanatariums having their own electric light plants—has created a demand for controlling devi-



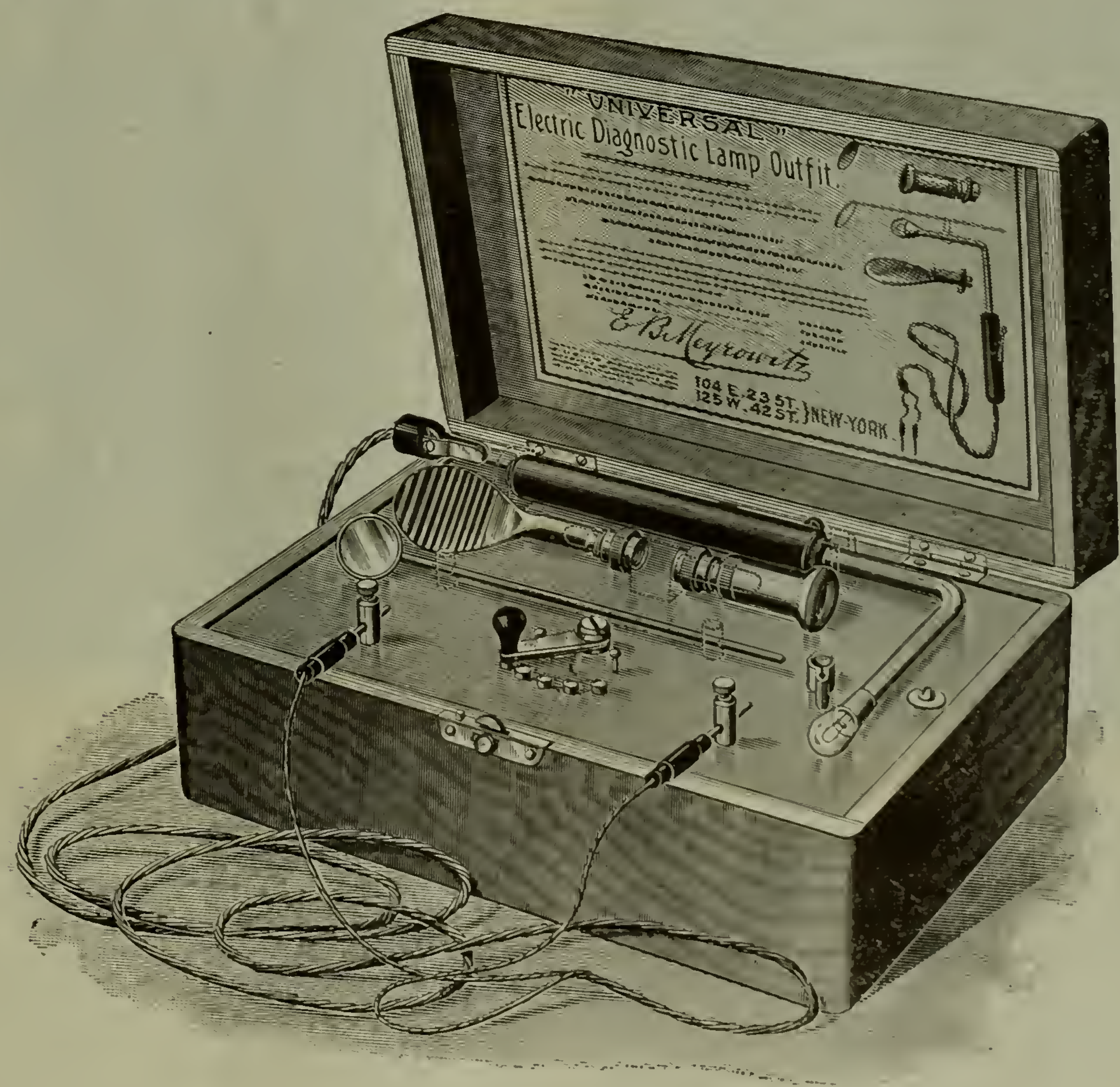
Vetter Volt Controller and Current Adapter.

ces by means of which the dynamic current could be employed with safety and scientific accuracy at the same time. A number of these devices are shown in the illustrations herewith, the first one being the Volt Controller, used in conjunction with the Diagnostic Lamp Outfit, which is also shown. The current controller, which is used with a Vetter current adapter, is employed as follows: the adapter is inserted in the electric light fixture and a 16 c. p. lamp placed in the adapter. The terminals of the connecting cords are attached to the binding p s s at the rear of the controller, the diagnostic lamp being



Details of the Universal Diagnosic Lamp Outfit.

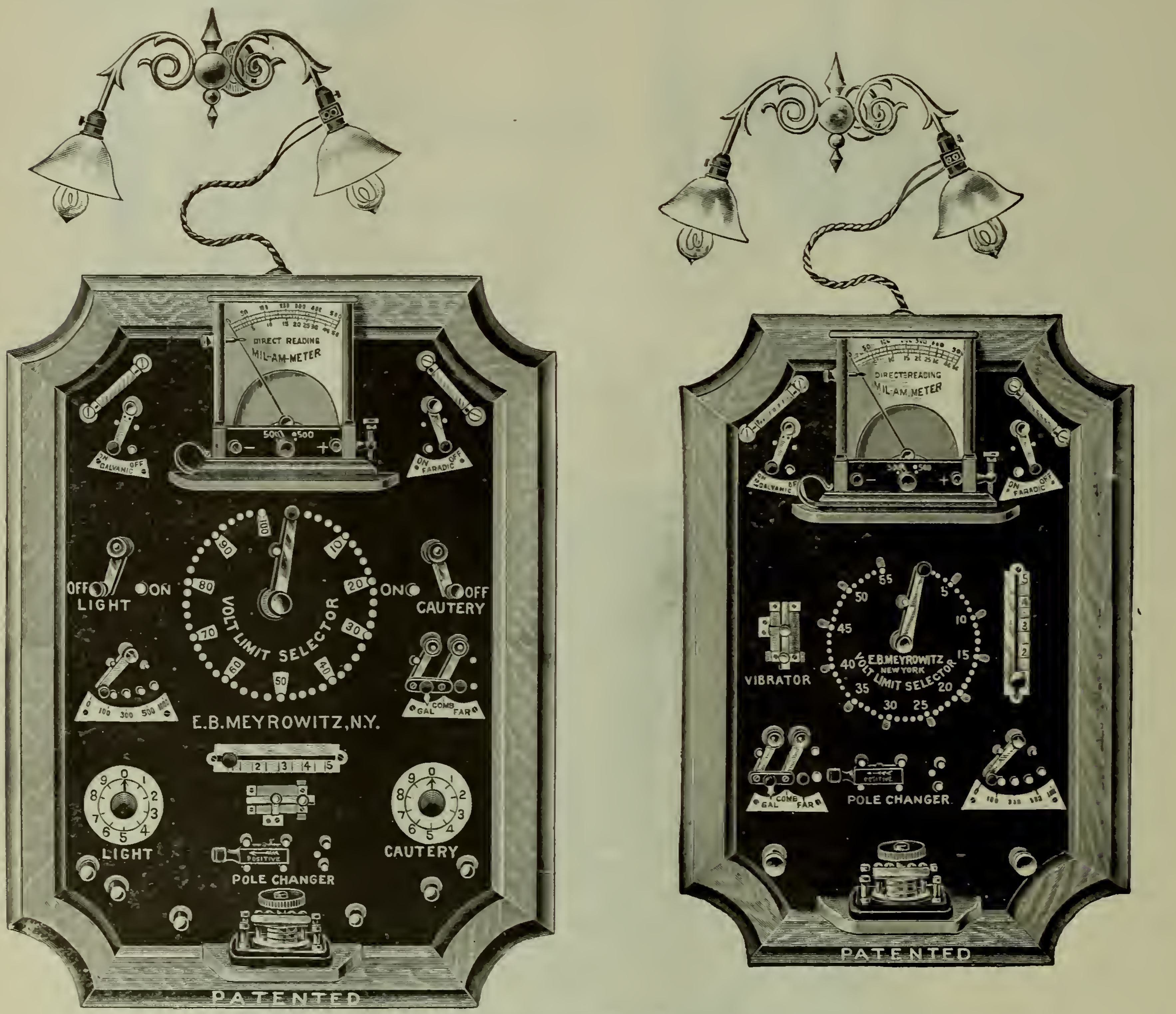
attached to binding posts at the front of the controller. The switch is then turned to the metal button and the black button slowly moved over the graduated scale, beginning at one, until the lamp burns brightly. If suffic-



Universal Diagnostic Lamp Outfit.

ient light is not obtained when the button rests at eight, the switch is turned off, the button moved back to one and a 32 c p. lamp is inserted in the adapter in place of the 16 c. p. lamp. The operation is then repeated until the desired amount of light is obtained. The capacity of a 16 c. p. lamp is half an ampere, that of a 32 c. p. lamp one ampere, etc. This controller, in connection with the Vetter series current adapter, gives perfect control over the voltage of the current employed and can also be utilized in operating cystoscopes, electric photophores and other diagnostic lamps which require a lower voltage than the current used. The Universal diagnostic lamp outfit, shown in illustration, consists of a throat illuminating lamp with tongue depressor, electric laryngoscope with small mirror and a trans-illuminating lamp for examinations of the antrum and frontal sinus, and may be operated by either battery or direct or alternating current.

Two illustrations of the Vetter complete electro therapeutic wall base are shown, as they appear when fitted to the wall. These wall bases, as they are called, contain within themselves switches, controlling and measuring devices, etc., so arranged that the physician's convenience is carefully studied in every respect. Each wall base designed contains a variety of instruments, such as a volt limit selector, a Vetter faradic coil, a De Wattville switch, etc. Controlling devices for cautery and diagnostic illumination are also supplied and a motor generator used for charging storage batteries contained in the cabinet proper. For physicians' use the advantages derived from the installation of electro therapeutic outfits can hardly be estimated. The above are manufactured and may be found on exhibition in the show rooms of E. B. Meyerowitz, 104 E. 23rd St., New York City.



Vetter Electro-Therapeutic Wall Bases.

TELEPHONIC.

A TELEPHONE MESSAGE COUNTER.

L'Electricien states that Mr. R. Van Kerckhove has designed an arrangement for recording the number of telephone messages passed through trunk lines from Brussels, and also for counting the same, and ensuring that just charges are enforced. The instrument can be manufactured at a very moderate price, and it partly solves the perpetual motion problem. On the outside there is a dial with the figures 1 to 5. The needle, when the conversation commences, stands at No. 5, and gradually moves back, indicating how many minutes the speaker still has at his command without extra charge. After 4½ minutes' conversation a stroke on a bell warns the user of the telephone that the time is almost up. Any further conversation after the five minutes has to be paid for, for which purpose the apparatus is reset. There is also provided a device by which, during the busiest portions of a day, a change can be made from the five minutes' to a three minutes' conversation.—Ex.

MISCELLANEOUS.

NEW BLOCK SYSTEM.

The Pittsburgh, Bessemer and Lake Erie is to install a block signalling system that is entirely new, the invention of M. V. Shriver, chief electrician. The system has telegraph and telephone features. Boxes will be placed on telegraph poles (the latter to be numbered to correspond with those on the boxes) at intervals of about one-quarter of a mile. The boxes will be connected with the company's wires, and, in case of a wrecked train or other disaster, by pulling down a lever the number of the box will be sounded at headquarters, and at the same time conversation carried on with the superintendent or officer in charge. The same system can be used for blocking and running trains and registering train numbers at headquarters. When an operator gives a train the block a bell is set ringing in his office, which does not cease until the block is removed. If he throws a switch and his signal is still at safety, it will notify the superintendent or other official to that effect, and the operator's attention can be called to the same.—Railroad Press.

AN ELECTRICAL SIREN.

An invention has recently been perfected in Ottawa, Can., Says the Electrical Era, which, it is said, may take the place of the now much used electric bell, and will also no doubt be extensively used as a fog signal at sea and along the shores where the fog signals are in use. The machine will be known as an electrical siren. The inventor of the new device is A. E. Trudeau, of Ottawa. He has been working steadily for over two years on this invention, and has just completed a large fog horn which will be tested on the great lakes as a fog signal. The machine is capable of producing a variety of sounds similar to those of a steam whistle, and be heard at a great distance. The sound produced is very harsh and penetrating. It can be placed at a point inaccessible to the ordinary steam plant now used in fog signalling, and can be operated by wires connecting the power at almost any distance. It is also proposed to utilize it as a burglar alarm. The mechanism of the new machine is very simple and compact. It consists of a large copper horn similar to that of a large base horn. The remainder is of iron.

THE DAVY ARC LAMP.

A description of a new enclosed arc lamp appears in a late number of London Invention, and to judge from the same it seems to have a number of meritorious features.

It is the invention of Mr. W. Davy, of Finsbury House, Bloomfield street, London Wall, London, E. C. The carbons are enclosed in a glass receptacle, independent of the globe which tones the light. The former is very nearly air-tight, and the whole arrangement is supported on springs which preserve it perfectly from vibration. As a result of the very slow combustion of the carbons and of the absence of vibration, the regulating apparatus, itself of a highly ingenious nature, and to be alluded to presently, has fair play, and perfect steadiness and absence of all noise whatever, are completely attained, and the light has, of course, all the power inseparable from arc lights generally. One important advantage obtained by the absence of vibration is that the glass enclosing the carbons does not become dirtied with black specks of carbon from the poles, which are very difficult to clean off. In the Davy lamp the only dirt that accumulates on the inside of the glass consists of white inorganic salts originally present as traces of impurity in the carbons. These salts are volatilized by the extremely high temperature, and condense upon the glass. There, however, they have have very little effect in stopping the light, and they do not adhere at all, and can be cleaned off with the greatest ease by means of a duster. The glass is big enough for the insertion of the hand for that purpose. As regards economy, it is only necessary to mention that the watt consumption per candle is only .5 in the Davy lamp as against 3 or even 4 watts in glow lamps. The fact of the arc being enclosed, and the glass enclosing it being free from danger of being broken by contact with white hot particles of carbon, prevents all risk of fire, even if the space between the glass and the outer globe were packed with inflammable material. The enclosure of the arc makes trimming much less troublesome. Open type lamps require trimming every eight hours, while the Davy will run for a week day and night without trimming. The regulating arrangement has the very ingenious feature that the pressure changes produced inside the glass receiver from alternations in the temperature of the gases inside as the current begins to vary are made to help the ordinary magnetic adjustment of the position of the carbon. The regulation becomes thus extremely sensitive and prompt and efficient in its action.

The Davy lamp weighs only 12lbs., and can be run either with a direct or with an alternating current, although the former is decidedly better, and there can be no doubt that a great future is before it.

ELECTRIC HAULAGE.

At a recent meeting of the Burgundy Section of the Societe de l'Industrie Minerale, Mr. Graillot showed the drawing of an electric haulage engine in which the speed of 1,000 revolutions is directly reduced to 25 revolutions per minute, so as to fit it for driving two endless chains for hauling wagons at the port. The electrometer is connected by a clutch with an endless screw having only one thread, and the lower part of which is immersed in oil. A ring, mounted on the shaft driving the chain, carries the pivots of forty small rollers which constitute the spur-gear teeth; and each revolution of the dynamo, that is, of the screw, allows a tooth to pass, so that the ratio of speed is as forty to one. The clutch, which permits of slip if necessary, is provided for preventing breakage in the event of the chain engaging in a fixed obstacle, because the dynamo, with its speed of 1,000 revolutions per minute, constitutes a powerful fly-wheel, which would, without this precaution, cause breakage of the chain if its travel were interrupted.—Ex.

AN ELECTRICAL INJURY.

A remarkable electric shock to an electrician occurred on the afternoon of March 7th, at the power-house on Lexington avenue and Twenty-fifth street, New York. Joseph Hampel was working at one end of the switchboard when there was a flash of light and the electric lights in the building went out and the electric cars over a large section of the city were stalled. Every particle of clothing Hampel had on, except the overalls and drawers on his right leg and part of the right shoulder of his undershirt and blouse, and a piece of his right shoe and stocking, was burnt off. His body was black as burnt cork and his hair was entirely burnt off. The floor was also burned, a large hole being made, into which he fell. He finally got his hand off the circuit, and yelling with agony ran out into the middle of the room, where a workmen extinguished the flames which were still licking the man's garments. An ambulance was promptly summoned, and it was found that he was terribly burned. He was taken to the hospital, and strange to say, it is probable he will recover.

The cause of the accident is unknown. It is thought that Hampel had been using a wrench tightening a screw on the switchboard, and in some manner the screw completed the circuit.—Scientific American.

TRAMWAY TRACTION.

At a recent meeting of the Birmingham (England) Association of Mechanical Engineers a paper on Electric Traction and Its Application to Large Towns, was read by Mr. G. Conally, engineer to the Birmingham and Midland Tramways Company. Mr. Conally holds that electric traction has been adversely influenced in this country by the insecurity to which proprietors were exposed by the Tramways Act of 1870. As to the best system for

use he regards the open conduit plan as too expensive for most situations. He referred to the fact that in Washington it had cost £11,400 per mile, and in New York from £10,000 to £20,000 per mile of single track. In England the cost of the conduit alone would be £10,800 to £12,000 per mile of single track. As regards the track itself, he thinks the practice of laying the rails direct on a concrete foundation a mistake, and advocates the interposition of longitudinal sleepers between this concrete and the rail. The additional elasticity thus obtained would, in his opinion, add to the life of both rail and rolling stock. The overhead sytem of traction has, on the whole, the most advantages, and of particulars types of this the Dickenson side contact seems the best, as it removes almost all objections against the overhead wires. —Ex.

AMONG THE SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 134 meeting of the Institute held at 12 West 31st street, New York, April 26th, was devoted to a topical discussion on "The Limitation of Power Subdivision by Electric Motors in Manufacturing Establishments." Mr. Gano S. Dunn of the Croker-Wheeler Co., opened the discussion, which was participated in by Messrs. R. T. Lozier, H. B. Coho, H. Ward Leonard, Arthur Williams, Jesse M. Smith, Oberlin Smith, Douglas Burnett, George Hill, and P. M. Pedersen.

At the meeting of the Executive Committee in the afternoon the following associate members were elected: Joseph Clement, Box 149, Johannesburg, S. A. R; R. Laurie Ellis, 230 Dyer building, Augusta, Ga.; John Ellis, Lonsdale, R. I.; Albert F. Ganz, 612 River St., Hoboken, N. J.; A. P. Kennedy, Maywood, Ill.; W. H. Lawrence, 49 West 26th street, New York, N. Y.; Oliver S. Lyford, Jr., 916 Lilac street, Pittsburg, Pa.; Raymond S. Masson, Mills building, San Francisco, Cal.; M. Namba, Kioto, Japan; John S. Peck, Pittsburg, Pa.; Walter Wilson Reed, General Electric Company, Schnectady, N. Y.; Edward F. Schurig, 306 City Hall, Omaha, Neb.; Charles Edward Skinner, 424 Franklin avenue, Pittsburg, Pa.; Gerard Swope, 342 South Jefferson street, Chicago, Ill.; Walter Farrington Wells, 72 East 77th street, New York, N. Y.; Robert A. Widdecombe, 1,653 Roscoe street, Chicago, Ill.; Walter Douglas Young, Roland Park, Baltimore, Md.

The following were transferred to membership: H. Eugene Chubbuck, Quincy, Ill.; William Slocum Barstow, Brooklyn, N. Y.

LITERARY.

"REAL RAPID TRANSIT TO FIFTY SUBURBAN TOWNS."

We are in receipt of a copy of the latest issue of the "Four Track Series," No. 23, entitled "Real Rapid Transit to Fifty Suburban Towns."

In this very useful publication, just issued by the Passenger Department of the New York Central, will be found a brief description of the towns and villages located on the Hudson, Harlem and Putnam Divisions within forty miles of New York. Here you will learn the distance from the city, the number of trains, time and rate of fare, with maps showing the location of each place, list of reliable real estate agents having places to sell or rent, etc. A copy will be sent free, post paid to any address, upon receipt of a one cent stamp by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

"ILLUSTRATED CATALOGUE AND PRICE LIST OF LUNDELL FAN MOTORS. CATALOGUE NO. 66."

The latest product of the Sprague Electric Company's literary department bears the above title and contains illustrated descriptions of the construction and various applications of the famous Lundell fan motors and also a detailed price list for the season of 1899. The cover shows a handsome little girl affectionately leaning on a Lundell fan motor and, judging by the contented expression on her countenance, she is apparently well pleased with her support. Copies of the above will no doubt be mailed upon application to the advertising department of the Sprague Electric Company, 20 Broad Street, New York City.

EXHIBITIONS.

ELECTRICAL EXHIBITION NOTES.

Each of the electrical exhibitions held in New York of late years has been distinguished by some special features. That of 1896 included the best public demonstration of the Roentgen rays, the transmission of power from Niagara, and the sending of a cable message around the world. The exhibition of 1898 included a complete church, lit by vacuum tubes, the application of electricity to street car traction, the first series of wax works ever made to illustrate the history of an art, the theaterphone, and the beginnings of wireless telegraphy. The prominent feature of the 1899 exhibition will certainly be automobilism. The exhibit of electric vehicles will be by long odds the largest and best ever seen in America, and second only to the great exhibits at Paris.

A great many other important features will be brought forward for the first time this year, among them the United States Government exhibit, which will include the following:

Flying Telegraph Cart.—This cart contains different types of light telegraph wires and cables, and is used with the advance guard of the army to keep the commanding general in constant communication with the front.

Telegraph wagon and truck.—Used for carrying a "central telegraph office on wheels," and the light steel telegraph poles used for rapid construction.

Hand wheels containing aluminum bronze wire.—This wire is used for sentry purposes, the soldier paying out the wire as he advances, and keeping in constant telephonic communication with the guard house.

Outpost cart, showing old type of wire for telephonic communication with outposts.

Switchboard used at Ponce, Porto Rico.—This switchboard was constructed by Lieutenant Colonel Reber out of sugar kettles captured from the enemy's plantation, showing the versatility of our army officers in constructing their needs out of whatever material may be found at hand.

Kit used at Santiago.—These historical instruments were the ones used at the battle of Santiago, over which was flashed the message of the surrender, and before that were constantly used in our intrenchments, keeping the White House informed of all the happenings at the front.

Map of battle line at Santiago.—Giving a diagram of how the signal officers connected the different intrenchments by telephone with headquarters.

Heliograph.—Used when it is impossible to string wires, to flash telegraphic signals by sunlight.

A display of the various instruments used by the Signal Corps for sending messages by wig-wag, telegraph, telephone, and night flash light methods will be made; signal flags and practice kits, international code flags, acetylene gas lamp, oil lamp and screen, main line sounder, Graham-Meyer torch, type C and D instruments. These instruments were designed by Colonel James Allen and are peculiar, owing to the fact that an alternating or buzz cur-

rent is used in the transmission of messages, thus enabling by the use of a transformer to raise the voltage to such an extent that a message can be sent over a great distance without the aid of relays.

Night signal system.—By this system, using the different combinations of colored lights, the vessels of the squadrons are enabled to communicate at night.

The following completes the list of exhibitors at the Electric Show:

Allgemeine Elektricitaets Gesellchaft, Berlin, Germany.

American Electrician Company, 26 Cortlandt St., City.

Appert Glass Company, 141 Broadway, City.

American Electric Specialty Company, 123 Liberty St., City.

Baker & Co., 120 Liberty St., City.

The Burnet Co., 115 Maiden Lane, City.

Columbia Incandescent Lamp Company, St. Louis, Mo.

Dickford Drill Company, Cincinnati, O.

Electrical Age, World building, City.

Edison Jr., Electric Light & Power Company, 27 William St., City.

Electrical World & Electrical Engineer, 9 Murray St., City.

Electricity Newspaper Company, Electrical Exchange building, City.

Electrical Review, Times B'ld., City.

Fischer Equipment Company, Chicago, Ill.

Fischer Foundry & Machine Company, Pittsburg, Pa.

The Hub, 24-26 Murray St., City.

W. S. Hill Electric Co., New Bedford, Mass.

F. Hardmuth & Co., Ratibor, Germany.

H. W. Johns Manufacturing Company, 100 William St., City.

Johns, Pratt Company, Hartford, Conn.

Incandescent Electric Light Manipulator Company, 116 Bedford St., Boston Mass.

J. Jones & Son, 64 Cortlandt St., City.

L. Katzenstein & Co., 357 West St., City.

Manufacturers' & Inventors' Electric Company, 96 Fulton St., City.

National Association Stationary Engineers, 120 Broadway, City.

National Photograph Machine Company, 85 Beaver St., City.

Ohio Electric Spec. & Manufacturing Company, Troy, Ohio.

Postal Telegraph Cable Company, 253 Broadway, City.

Street Railway Journal, 26 Cortlandt St., City.

Stanley Electric Manufacturing Company, 71 Broadway, City.

Union Boiler Tube Cleaner Company, Pittsburg, Pa.

Henry B. Van Keuren, Brooklyn, N. Y.

Whitney Electrical Instrument Company, Penacook, N. H.

Wright Disc Meter Company, Brooklyn, N. Y.

Western Electrician, Chicago, Ill.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING APRIL 25, 1899, $99,312.00.

New York, April 25, 1899.—The following exports of electrical material are from the port of New York for the week ending this date:

Argentine Republic—Sixty-three packages electrical material, $2,767; 126 packages electrical machinery, $10,370.

Antwerp—Fifty-six cases electrical material, $8,103; 1 case electrical machinery, $540.

Bremen—Seven cases electrical material, $350.

British East Indies—Forty-six packages electrical material, $1,278; 2 cases electrical material, $61.

British Guiana—Fifteen packages electrical material, $305.

British Australia—Forty-one packages electrical marial, $1,735; 2 cases electrical machinery, $55.

Brazil—Seventy-four boxes electrical material, $1,596.

British West Indies—Thirty-five packages electrical material, $1,485; 18 packages electrical machinery, $470.

Cuba—Forty-nine packages electrical material, $1,596.

Chili—Ten packages electrical material, $45.

China—Two cases electrical machinery, $54.

Central America—Twenty-nine packages electrical material, $96.

Ecuador—One hundred and eighty-two packages electrical material, $1,445.

Glasgow—Five packages electrical material, $670; 12 packages electrical machinery, $1,200.

Hayti—Six cases electrical material, $130.

Hamburg—One hundred and twenty-two cases electrical material, $14,705.

Havre—Thirteen cases electrical machinery, $3,416; 215 packages electrical material, $13,837.

Hong Kong—Twelve cases electrical material, $251.

London—Three hundred and eighty-six cases electrical material, $17,847; 19 packages electrical machinery, $904.

Liverpool—Nine cases electrical material, $315.

Mexico—Four packages electrical machinery, $900.

Nova Scotia—Two cases electrical material, $23.

Newfoundland—Seventeen cases electrical material, $433.

Palermo—Two cases electrical material, $26.

Philippines—Forty cases electrical material, $1,200.

Peru—Fifty-two cases electrical material, $373.

Riga—One case electros, $2.

St. Petersburg—Sixty-seven cases electrical material, $1,232.

Southampton—Fifty-seven cases electrical machinery, $702; 1 case electros, $63; 10 cases electrical material, $186.

Tasmania—One electric hoist, $920; 1 electric motor, $35.

United States of Columbia—Four packages electrotypes, $72.

Uruguay—Three cases electrical material, $80.

Venezuela—Sixty-one packages electrical material, $461.

NEW CORPORATIONS.

Chicago, Ill.—Electric Machinery Co., has been incorporated by G. B. Oehlert, R. R. Lane, and E. R. Francis; manufacture electric machinery; capital stock $5,000.

Philadelphia, Pa.—Protected Rail Bond Co., incorporated by Charles J. Mayer, A. H. Englund, E. R. Ross, F. R. Shattuck, and Edward Everett; electric material and apparatus; capital stock $25,000.

Bluefield, W. Va.—East River Electric Co., incorporated by W. A. Cather, Edwin Mawn, W. P. Hawley, G. A. Shirley, and R. E. Johnson; electric machinery; capital stock $50,000.

New York, N. Y.—Gould Storage Battery Co., incorporated under the laws of West Virginia, by Charles A. Gould and others; capital stock $5,000,000.

Decatur, Ala.—The Decatur Light & Power Co., has been reorganized and the new company has purchased the electric light plant of the General Electric Co., of New York, and will operate both the old gas plant and the electric plant.

Elizabeth, N. J.—The Essex Union Water & Light Co., has been incorporated by Carroll P. Barrett, Frederick Green and Frederick R. Drake, to carry on a general electrical business in any State or Territory of the United States; capital stock $500,000.

Jersey City, N. J.—Electro Antiseptic Co., incorporated by Charles H. Mulford, Harry L. Timm and others; capital stock $115,000.

East Orange, N. J.—New York Electric Brake & Coupler Co., incorporated by George W. Harrison and others, to manufacture electric brakes; capital stock $1,000,000.

Wilkesbarre, Pa.—People's Light & Power Co., has been incorporated by R. M. Hughes, Jacob Roberts, Jr., M. Gaertner, S. J. Tonkin, T. F. Ryman; capital stock $5,000.

Dover, Del.—O'Kelly Electric Contract Co., has been incorporated by T. St. John Gaffney, Henry D. McGowan, and James L. Wolcott; capital stock $75,000.

Hattiesburg, Miss.—The Hattiesburg Electric Light & Water Co., incorporated by James L. Coker, Jr., and others; capital stock $2,000.

Blackstone, Va.—The Blackstone Electric Co., incorporated by J. M. Harris, George P. Adams, L. C. Tucker and others; capital stock $3,000.

TELEPHONE CALLS.

Springfield, Ill.—Farmers' Telephone Co., has been incorporated by Edgar D. Rankin, John McIntosh and Frank E. Abbey; capital stock $2,000.

Springfield, Ill.—Farmers' ETAOI ARHTS ETH Hm

Jamestown, Ind.—Citizens' Telephone Co. has been incorporated by J. O. Finch, C. F. Martin, Thomas W. Porter and Julius Kerbaugh; capital stock $500.

Clarendon, Ark.—The Clarendon Telephone Co., incorporated with J. S. Thomas, president; M. J. Manning, vice-president, and J. B. Lee, secretary-treasurer; capital stock $4,000.

Chetopa, Kan.—The Indian Telephone Co., has been incorporated with a capital stock of $10,000.

New York, N. Y.—The New York & Boston Telegraph & Telephone Co., has been incorporated, with a capital stock of $5,000,000.

Richwood, O.—Richwood Telephone Co. has been incorporated by C. D. Juvehall, N. E. Liggett, George W. Worden, M. C. Walgenot, Edward A. Schambe; capital stock $10,000.

Robert Bonner, millionaire, owner of the N. Y. Ledger.

Newton, Ind.—Newton Telephone Co., has been incorporated by Charles R. McKinney, Thomas Shultz, Robert Campbell, Robert W. Claypool, and Charles E. McClure; capital stock $3,500.

Flora, Ind.—Bringhurst & Flora Telephone Co., has been incorporated by David E. Miller, Wilson Eikenberg and G. F. Shigley; capital stock $14,000.

Utica, N. C.—Webb Telephone & Telegraph Co., incorporated by Daniel F. Stroebel, Bartlett Manion, M. H. Bullock, F. E. Schenck, and C. H. Van Aiken; capital stock $10,000.

Warren, O.—The United States Telephone Co. of Cleveland, has been granted permission to connect with independent lines in Warren and Niles.

Kalkaska, Mich.—Waverly Telephone Co. has been incorporated, with a capital stock of $50,000.

Trenton, N. J.—Scranton Telephone Co., in corporated by William C. Hendrickson, Edward Barneman and others; capital stock $300,000.

POSSIBLE INSTALLATIONS.

Williamsport, Md.—The Mayor may be addressed concerning proposed erection of electric light plant.

FLASHES.

Boston, Mass.—Electric Gas Light Co., damaged by fire.

JOTTINGS.

EDISON MANUFACTURING CO. and the National Phonograph Company have removed to 135 Fifth Avenue, corner of 20th Street, New York City.

SCHMIDT & BRUCKNER, the well known telephone manufacturers, have removed their offices and works to the northeast corner of Elm and Howard Sts., New York City, where they have a large and well lighted loft, especially adapted for their growing business.

STREET RAILWAY JOURNAL has removed its offices from 26 Cortlandt street, to 120 Liberty street, New York City.

PHOENIX ELECTRIC TELEPHONE CO. have removed from 93 Washington St. to 443-445 Greenwich St., corner of Desbrosses St., New York City, where they have a floor containing over 8,200 square feet. This means a great convenience, saving of time and labor, the works always being under the direct control of the office.

THOMAS & BETTS, of the Washington Life Building, 141 Broadway, New York City, have been appointed the New York, New Jersey and Philadelphia agents for "Armorite" and "Armorduct," as well as for "Loricated Conduit." Messrs. Thomas & Betts are also agents for the "Helios" arc lamps, Chase outlet boxes and New York Flush switches.

MR. A. W. KEONIG has been appointed the authorized representative and salesman for the Belknap Motor Company, Portland, Me., for the Middle Atlantic and Southern States. Mr. Koenig will push the sale of the Belknap Company's various manufactures, such as the Chapman voltage regulator, B. C. Standard electric motors and dynamos, brushes, am. and voltmeters, etc. Communications addressed to Room 507, Gill Building, No. 9 Maiden Lane, New York City, will receive as prompt and careful attention as though sent direct to headquarters.

HAGEBORN & WARD MFG. CO., of Brooklyn, N. Y., are making a fine line of enclosed and open arc lamps for series alternating and direct currents. These lamps are of an entirely new design throughout; the mechanism is all new and simple and many of the defects found in lamps now on the market are overcome.

COLUMBIA ELECTRIC SUPPLY CO., of 329 4th Avenue, New York City, and 55 Maiden Lane, Albany, N. Y., are fitting up the large store and basement at No. 93 Liberty St., New York City, and will occupy the same about May 15th. The Fourth Ave. store will be retained as a branch office.

The Wireless Telegraphy Company of England have been approached by the representatives of a proposed syndicate which desires to acquire the sole rights of establishing wireless telegraphic communication between England and America. It is stated that the proposal is made in all seriousness, and there is every possibility of its being carried to a practical issue if the company and the syndicate can only come to terms. The directors of the company will consider the matter at their first meting, which is fixed for an early date.—Ex.

The Electrical Age.

VOL. XXIII—NO. 19 NEW YORK, MAY 13, 1899 WHOLE NO. 626

AUTOMOBILES.

Riker Electric Phaeton.

Riker Electric Two Passenger Trap.

RIKER AUTOMOBILES.

The commentaries of some of our contemporaries on the charm of the bicycle have lost weight in face of the evidence which proves that the charm of the automobile is an everlasting recollection in the minds of those that have experienced its delights. We cannot say that cosmopolitan cities are "automobile mad" because at present this new and latest luxury has been beyond the means of the great masses, but the time is slowly but surely approaching when the automobile and bicycle will be spoken of in the same popular manner as articles of common use.

The Riker Electric Motor Company, of 45-47 York St.,

Brooklyn, N. Y., have built a series of atomobiles which partake in every respect of that elegance of finish, handsome construction and ease of operation which will inevitably bring the higher class of automobile to the front.

Riker Electrlo Delivery Wagon.

The Riker victoria, phaeton, two passenger trap, four passenger trap, surrey and tricycle as well as delivery wagon are triumphs of the engineering art. Light, springy, durable and capable of covering twenty-five miles of ground there is little left for the tourist, merchant or city resident to wish for, each being supplied with an ideal means of locomotion which is relatively inexpensive, absolutely non-dangerous and under complete and absolute control at any instant as regards speed or stopping.

Riker Electric Four Passenger Trap.

Looking upon the automobile from a business standpoint little need be said of the possibilities of its infinite development for trucking and light and heavy delivery work. The use of storage batteries whose reliability is unquestioned have greatly assisted in this rapid progress in the line of street vehicles. From a purely domestic standpoint the care of the automobile is reduced to a minimum, as those homes supplied with electricity can readily and conveniently recharge the cells without it being necessary for them to possess a technical knowledge of electricity. For physicians the readiness with which an automobile is put on the road is an ever constant source of satisfaction. As regards the expense of maintenance the proposition seems to be somewhat as follows: a horse, carriage and groom would invite an outlay the first year of between twelve and fifteen hundred dollars with the ever present risk of equine deterioration. Veterinary expenses may bring up the total to still higher figures with risks greatly increased in wet weather and with slippery ground. After the first outlay the second year of expense will be at least five hundred dollars, the owners of the trap being subjected to many inconveniences and a very limited run in warm weather, when it is most needed. An automobile on the contrary covers a distance of twenty-five miles without fatigue. Its first cost is about one thousand dollars or more, depending upon the style of rig. The expense for attendants is practically nothing and the cost of electricity a mere trifle

per month. The storage batteries, if well cared for, will last several years without renewal so that the electric carriage, from a money standpoint, is an excellent investment. So far as convenience is concerned the merest tyro can speak volumes in their favor. The Riker Electric Motor Company have an exhibit at the Electrical Exhibition at which they show some of the handsomest samples of automobiles. Andrew L. Riker is president, J. B. Malone, secretary and treasurer and Thomas L. Proctor, general manager of the Riker Electric Motor Company. Mr. A. H. Whiting acts in the capacity of representative among the trade.

Riker Electric Tricycle.

A memorial will shortly be erected in honor of Clerk Maxwell in the parish church of Corsock, near Edinburgh, Scotland. The world is only coming to appreciate the splendid mathematical genius and beautiful character of this man, who appeared so humble and modest that you would have passed him on the street without taking the least notice of him. Yet his mathematical researches in electricity are the foundation of all our modern developments, such as Hertzian waves, Roentgen rays, wireless telegraphs, and Tesla torpedoes. He had not the vehement energies of Lord Kelvin; he was a gentle soul, but his genius was perhaps equally high and penetrating, and his work will remain as long as Kelvin's.—Ex.

Riker Electric Surrey.

J. D. Rockefeller's representatives are planning the erection of a mammoth electric plant to operate a railroad and factories at Everett, Wash., which Rockefeller controls. Among these are the Everett & Monte Cristo Railway, sixty-five miles long; mining machinery and concentrator at the Monte Cristo mines, a paper mill, nail works, a smelter, and a city lighting plant. Power for these is now produced by steam at large expense. It is found that by using electricity enough saving can be made to pay for the electric plant in three years. Engineers employed by Rockefeller's agents have made surveys along Stillaguamish River, finding a good dam site at Granite Falls. This dam will furnish water power to generate all the electric energy required.—Ex.

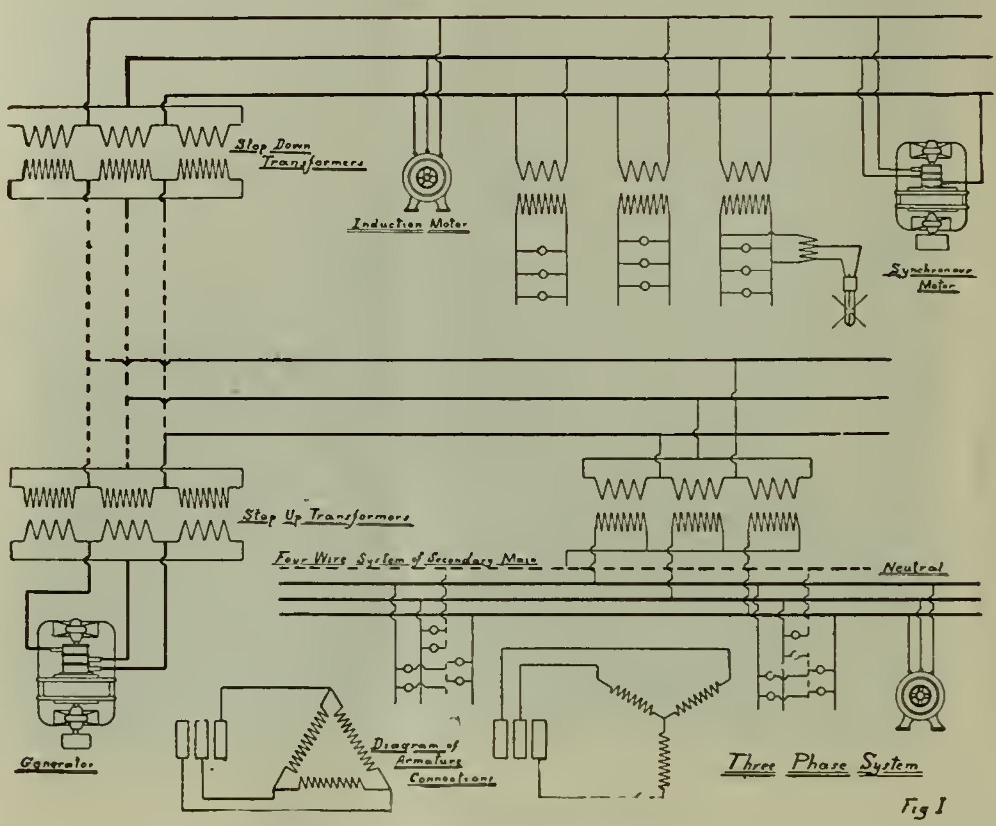
With the idea of affording their patrons the best service possible, Reynolds & Company, of New Haven, Conn., have arranged with Messrs. Topping Brothers, of No. 92 Chambers street, New York city, to carry a full line of their set and cap screws and to represent them, in so far as these goods are concerned, in the metropolitan district. Topping Bros. will be prepared to fill all orders of ordinary proportions from stock, without the slightest delay, at lowest market rates.

Mr. C. S. Rusling, formerly manager of the Kansas City Thomson-Houston Co., and now of Philadelphia, Pa., was in town a short time ago. Mr. Rusling is just as chipper as ever and ever on the alert for a good investment.

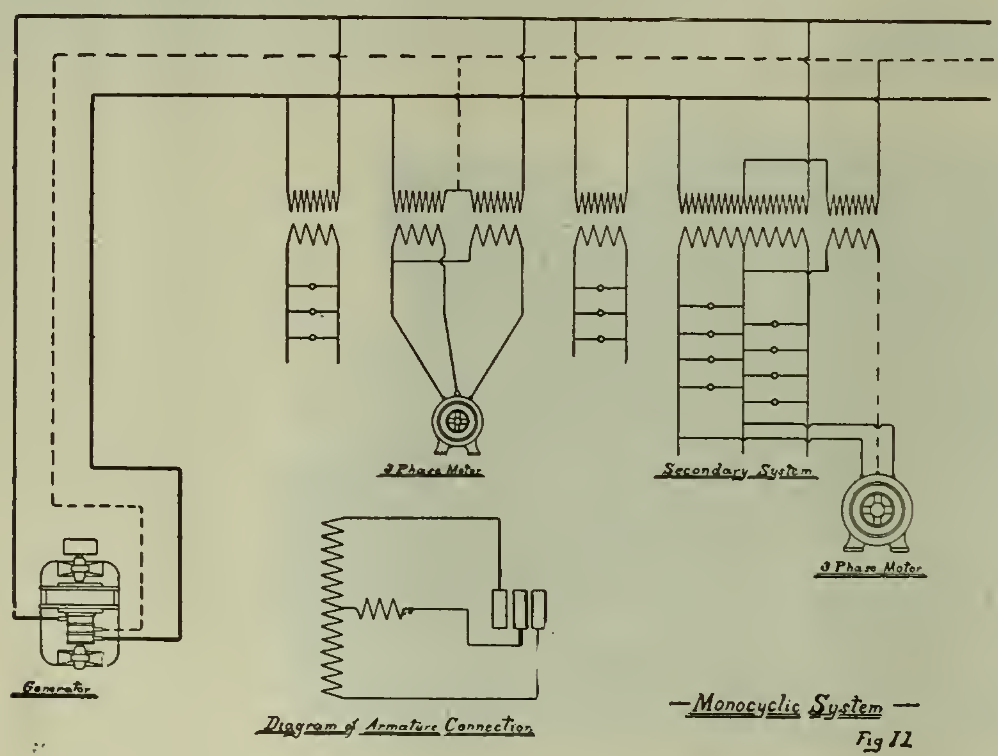
TECHNICAL NOTES.

THE PARTS OF A WIRING SYSTEM.

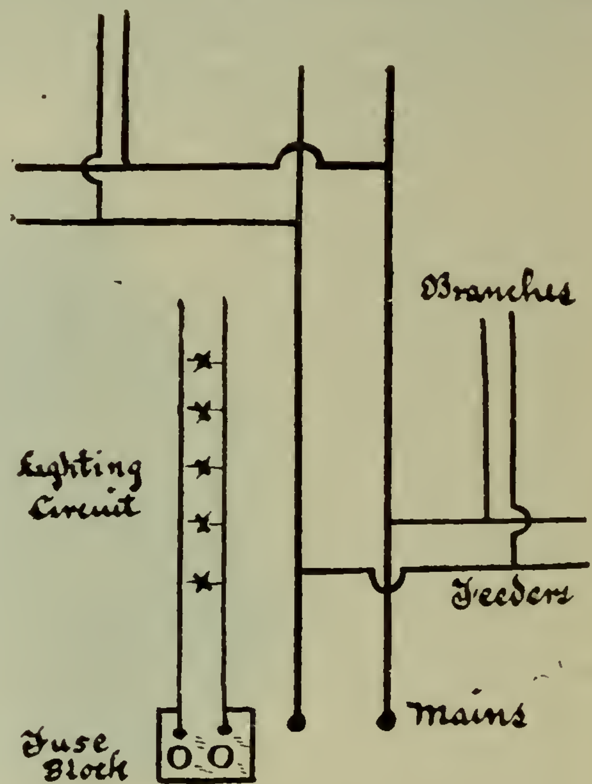
The parts of a wiring system possess a variety of names to judge by the statements of some youthful contractors. For the benefit of such we desire to show by diagram mains, feeders and branches. From these three ramifications a fourth may spring, running to side lights, etc., but as a general rule the mains are considered first, the branches and their auxiliaries last, leaving the feeders second. Sometimes the mains are called bus wires, and it is the practice to-day to call the heavy copper bars on a switchboard bus bars. The origin of this term may be found in the word omnibus, which is a carryall, shortened in English phraseology to bus. In other words, a carryall or bus wire deserves its names from its capacity for current. A more appropriate expression, seems to us, is to use the word feeder in such cases, although relatively speaking, the mains are carryalls for the feeders, the feeders serving in the same capacity for the branches.



Connections of Three Phase System.



Connections of Monocyclic System.



Elements of a Wiring System.

MONOCYCLIC AND THREE PHASE SYSTEMS.

Two well known systems of alternating current transmission and distribution are shown in figures 1 and 2; the three phase and monocyclic systems respectively. In the monocyclic system three wires lead from the generator in exactly the same way as we may observe in the three phase system and by the system of connections shown lamps can be run from transformers and three phase motors operated with perfect ease. The diagram of armature connections of the monocyclic systems are shown in the lower part of the sketch, which follows out the star plan. This system does not possess the advantages of the three phase in many respects, which are best taught by experience. The armature connections of the three phase systems, as shown in figure 1, are indicated on the bottom

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ELECTRICITY IN ITALY.

"The Financial News," of London, England, contains a most interesting paragraph on electrical developments in Italy. It is only proper for us to expect to see the signs of electrical enterprise in a country which gave to us two of the greatest men in the history of scientific discovery. In addition to Volta and Galvani we must not forget that Pacinotti, the inventor of the toothed armature, was an Italian professor in one of its numerous universities. From Italy the great western hemisphere has received numerous benefits and its influence upon civilization has been felt in art as well as science and in both its historical and geographical development. The writer in the above mentioned paper states that the part electricity is playing in Italian industrial life is very great Even insignificant villages are sufficiently interested in the application of this form of energy to give up oil and gas systems which for their purposes were quite sufficient to replace them with complete electric light installations. Many municipalities are being overrun by franchise seekers and, strange as it may seem, in Rome itself, the Gate of Heaven, the very site of that most barbarous of institutions, the great amphitheatre, is now constantly traversed by the modern fly-away, the electric automobile. All the principal cities of Italy are being interlaced with electric traction systems and a great syndicate of moneyed men and manufacturers from Rome, Brescia, Turin, called the "Societa Elettrosiderurgica Camuna," intend to handle a most important patent taken out by an inventor named Stassano for the purpose of producing iron direct from the ore in an electric furnace. Other companies have been and are being formed for the promotion of arc and incandescent lighting and the development of electric roads throughout the country. In the mountain districts power transmission is being carefully considered and within the next few years it seems likely that Italy will rank in this respect among the most enterprising nations of Europe. A visitor to Rome at this present day will find in spite of its unique appearance all the signs of an intense industrial activity, strongly developed along engineering lines. The lighting of the Pyramids of Egypt will now be more than offset by the illumination of the Catacombs of Rome by the same means. The day is not far distant when the electric carriage will pass through the streets of the fated cities of Herculaneum and Pompeii upon which will be shed the rays of the latest improved enclosed arc. Surely the very antipodes of the times are meeting at the close of the nineteenth century

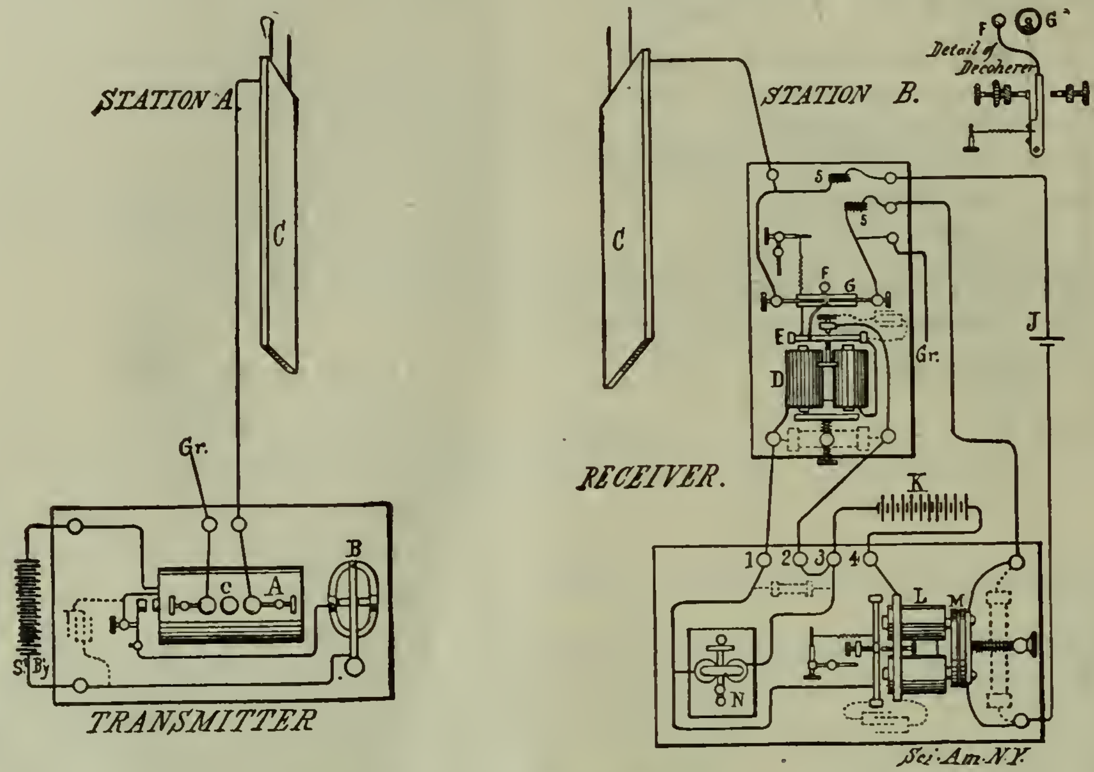
TALKING ALONG A RAY OF LIGHT.

It seems very much like a fairy tale to hear of a public exhibition being given showing how human intellligence can be transmitted along a beam of light. At the Electrical Exhibition, on Saturday afternoon, May 13th, the radiophone was shown in operation. This is an instrument of such construction that by means of a search light beam, speech can be transmitted a distance of seventy-five yards and heard with distinct enunciation. The property of selenium makes it immediately susceptible to the influence of light so that if used in conjunction with some variable light producing apparatus a telephone in circuit with it will give issuance to sounds in perfect harmony with these optical changes. A system of this kind can truly be called wireless telephony thus giving prominence to this latest exposition as the first in the world's history in which telegraphing and telephoning was carried on without a visible intervening medium between the transmitter and receiver. We remember in the fables of the Arabian Nights of the magic eye piece by means of which one of the characters delineated there was able to see the actions and motions of his friends though miles away from them. We have practically reached that state of ideal development, for at this present hour it is possible to send sketches over the wire through a distance of hundreds of miles, to send speech and signals through the ethereal atmosphere without employing the familiar means hitherto in use. Tesla's idea of transmitting power in vast quantities without wires at a distance far above the upper strata of clouds is one which may receive considerable attention in the near future. Within the last fifty years Americans have begun to invent and apply the forces of nature for many utilitarian purposes. If progress keeps up at the rate indicated there is much truth in the statement "that the marvels of the times have not yet appeared" for it seems very likely that many of our fondest delusions will be shattered by scientific successes which may strike out from Funk & Wagnall's dictionary the word "impossible." The radiophone represents an old principle though a new construction, but selenium, the metal utilized, seems to be permanently associated with all experiments that lead us to hope that images and speech will some day be transmitted commercially without wires. In our efforts to reach a higher efficiency in mechanical and commercial operations we are not overreaching ourselves in directing investigations along such a channel of inquiry. The wireless telegraph system has come to stay. Why not wireless telephony?

of the sketch, both in star and in mesh form. The wires leading from the generator to the step down transformer and the further distribution of the power for light and transmission purposes, is clearly indicated. Three phase motors, of course, can be used on either system, but the wide spreading use of the three phase system shows that its popularity is founded upon a most satisfactory experience. In figure 1 both step up and step down transformers are shown on the same line.

CONNECTIONS REQUIRED IN WIRELESS TELEGRAPHY.

The transmitter of the wireless telegraphy system, as shown in the illustration, consists of a cylinder of oil, plugged up at each end by a brass ball, through which the discharge passes. The discharge likewise passes through two air gaps which, as shown in illustration, result from the position of two smaller brass spheres. From this transmitter the waves spread and strike the receiving instrument. In the line sketch of transmitter and receiver the details of connections are shown as employed in practice. It will be observed that one ball of the transmitter is connected to the earth and one wire leading from the coherer likewise as the receiving end. The employment of plates of metal or any similar device for receiving transmitted waves has added greatly to the success of this system. The transmitter, as shown, operated by storage batteries, spark coil, etc., can be adjusted to regulate the size of the wave. The coherer shown at the receiving end can be similarly adjusted to respond to the primary impulses. Marconi has thus far succeeded in transmitting signals a distance of thirty miles. A further extension of this principle may lead to quite a revolution in telegraphy.



Connections of Wireless Telegraph System.

View of Transmitter Used in Wireless Telegrapy.

EXHIBITIONS.

THE ELECTRICAL EXHIBITION OPENED AT MADISON SQUARE GARDEN.

lectricians and thousands of others interested in electricity attended the opening of the Electrical Exhibition, at Madison Square Garden, on Monday evening, May 8th. Governor Roosevelt opened the exhibition by pressing a golden telegraph key in the Executive Mansion at Albany. Messages of congratulation were read from President McKinley and the Governor by Chauncey M. Depew who presided at the opening ceremonies. President McKinley telegraphed as follows:

"I am glad to have an opportunity to participate in the exercises incident to the opening of the annual Electrical Exposition this evening, and to congratulate those who are contributing to an increased knowledge in the field of electrical research and development. You have my best wishes for the success of the Exposition."

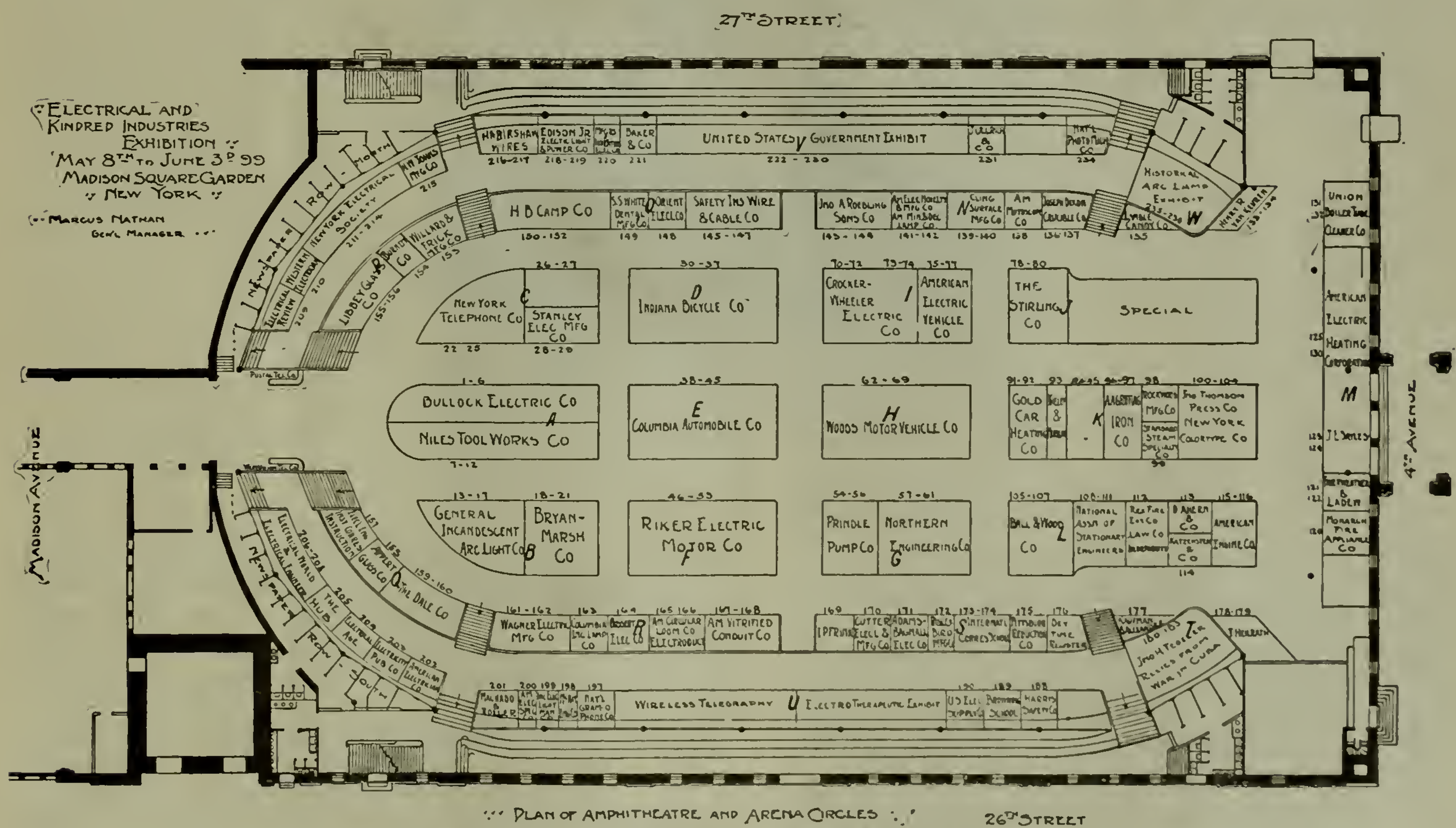
Governor Roosevelt's message read:

"Congratulations on successful opening Exhibition National Electric Light Association, marking centennial of Volta's great discovery of the electric battery and another step in the application of electricity to man's safety, welfare and comfort."

After reading the two telegrams Dr. Depew made a few remarks in his usual happy vein, which were received with the greatest enthusiasm. He said:

"We had thought that its limits were reached in the inventions of the telegraph, the telephone and the motive power, but the inventions of the past year are more important and more startling than all those which have preceded. Now we find that electricity is being turned to a hundred purposes in medicine, in the system of the human body, in the relief of human suffering and in the aid of human health. A Roentgen ray locates where the bullet is, and locates where the fracture can be found, but within the last year these medical electrical gentlemen put an electric bulb in the inside of your stomach and it reveals the process of digestion. The result is that digestion, or rather indigestion, which has been a horror of the human race for all time, is yielding to the processes of electricity. Electricity is attacking rheumatism; electricity is assailing gout; electricity is curing paralysis, is shedding light upon the blues. It is teaching us to prolong existence, and I predict that the time will soon come when every man and every woman can carry in their pockets an electrical machine by which the waste of matter can be overcome; and the human being will be like an apple in the cold storage warehouse, preserved just as he is, when he takes that electrical machine, for as many hundred years as he wants to live.

"The most remarkable and the most extraordinary invention of recent months has been the perfection of Marconi's system of wireless telegraphy. When the battle of Bunker Hill was fought it took two weeks for the news to reach the Continental Congress in Philadelphia. When Cervera's fleet was sunk in thirteen minutes by the guns of the American ships off Santiago we knew it ten minutes afterward There was a small fleet of American men-of-war 6,000 miles from here, on the other side of the ocean, in the Eastern Hemisphere. By the declaration of the war with Spain they were not permitted to coal, not permitted to get supplies anywhere—all ports were closed. Thew went on the ocean, we lost sight of them for a week. They sailed finally passed forts, over mines, into Manila



Floor Plan of Electrical Exhibition at Madison Square Garden.

Bay, and there they met the foe and conquered him, met the ships of the Spanish Navy and conquered them, and Dewey became the great hero of the American Navy. That was 6,000 miles away. That battle made us a world power. That battle closed our history of the past and opened for us a new and glorious history for the future, and the knowledge of that victory was received here before the smoke of the guns disappeared from the harbor of Manila."

Dr.Depew's speech was followed by the playin of the "Star Spangled Banner" amid great applause and after messages of thanks had been sent to the President and Governor the show was declared open.

SCENES AT THE ELECTRICAL SHOW.

THE ELECTRICAL EXHIBITION COMPANY, and Mr. Marcus Nathan, the general manager, in particular, cannot be too highly complimented on the success of their enterprise, the Electric Show. Mr. Nathan with tireless energy has been employed twenty hours out of every twenty-four,—especially during the week ending May 8th,—in personally supervising the many electrical installations anu completing the exhibits which now beautify Madison Square Garden. The many startling innovations such as talking over a beam of light, the wireless telegraph and telephone, the X-ray exhibit, the great diving exhibition, the electrical breeze and accompaniments in the Grotto in the basement are all suggestions of his busy brain, carried out by his many assistants.

The Grotto is a marvel of ingenuity and, beautifully lighted by incandescent lamps, it presents a sight remind- the visitor of the famous Luray Caves. The wireless telegraph exhibit is presided over by Dr. Kerner, one of the noted lecturers of this country. Dr. Kerner is an old time electrician and an inventor of considerable repute, the present successcful Holmes telegraph system being without doubt the product of the doctor's brain. Dr. Kerner has travelled through every country in Europe and his descriptive illustrated lecture on the Passion Play, as produced in Germany, is about the best lecture ever given on the subject.

We have only enumerated a few of the many attractions which make the 1899 Electrical Show the greatest electrical exhibition held in the United States up to date and advise our readers to see for themselves the gigantic strides which electricity is making in all the arts, sciences and industries.

Madison Square Garden has never been better illuminated than by the present sixty clusters of twenty ground glass lamps each, suspended from the girders and distributed throughout the Garden. The general lighting of the exhibition was done by the Norden Electric Works, of 149 W. 28th St., New York City, Mortimer Norden, general manager and Chas Kirkland, superintendent. They installed about three thousand lamps for the different exhibitors and the booths fitted out by this concern reflect great credit upon its young and industrious members. Throughout their work in the Garden they were ably assisted by Messrs. J. W. Johnson and Edward Tobias. A specimen of their excellent workmanship is shown in The Electrical Age booth and sign.

On entering the Garden from the Madison Avenue entrance and up the stairway to the balcony we pass along what is commonly termed "Newspaper Row," on which are situated the exhibits of the electrical press. Prominent among these is THE ELECTRICAL AGE, shining in a blaze of colored lights, with Old Glory in the background, enclosed in a handsome frame, and chairs and tables ad libitum arranged for the convenience of visitors. Here the visitor will find the latest in electrical literature and attendants ready to furnish any desired information.

Mr. Marcus Nathan, Manager of the Electrical Exhibition.

MACHADO & ROLLER, of 203 Broadway, New York City, exhibit a full line of the well known Whitney electrical measuring instruments, resplendent in aluminum cases as well as their other electrical specialties, all arranged in an attractive manner.

INCANDESCENT ELECTRIC LIGHT MANIPULATOR CO., of 116 Bedford St., Boston, Mass., show their incandescent electric light manipulator and cleaner, which is fully described and illustrated in annother column. Mr. Frank W. Morse, the treasurer of the company, ably explains the advantages and conveniences of the manipulator and cleaner.

WAITE & BARTLETT MANUFACTURING CO., of 108 E.23rd St., New York City, manufacturers af elec-

tro-medical and surgical instruments have installed one of their large Ramney Wimshurst-Holtz machines. This machine is operated by a small Croker-Wheeler motor and is furnishing the refreshing electrical breeze in the little house in the Grotto. Dr. Henry E. Waite, the president and general manager of the company is often seen at the booth welcoming his friends.

PROF. T. M. ST. JOHN, the author of "How Two Boys Built Their Own Electrical Apparatus," is in charge of the Browning School's exhibit, on the south balcony. Prof. St. John's book ie deserving of the highest recommendation of professional and operative electricians; the simple and practical descriptions of how to build electrical apparatus, as set forth in this book, will be appreciated by every student, novice and practical worker in the field of electrical application. Samples of the work turned out by Prof. St. John's two pupils can be seen at the school's exhibit.

THE GRAMAPHONE exhibit, just beyond Newspaper Row, is the musical wonder of the show and can be heard all over the Garden. Its is one of the biggest ads at the exhibition.

THE ELECTRIC PIANOPHONE is another of the musical entertainers of the show, playing any kind of music. As the Pianophone Company states in its circular "it entertains, instructs and cultivates."

THE SAFETY INSULATED WIRE AND CABLE COMPANY'S exhibit is one of the most attractive at the show. It is a specially designed and constructed little building, containing an office and reception room; to one side are samples of the Safety Company's various wires and cables, handsomely mounted and arranged to catch the visitor's eye. On the back of the reception room and facing the main floor are different electric signs, the most unique and attractive being the one containing the words "Contractors to the U. S. Government," composed of colored electric bulbs. This, with the other constantly changing electric light signs, is the first thing to attract the attention of visitors on entering the Garden. A pamphlet entitled "Safety—The Eloquence of Success" is distributed at the booth. To the eloquence of Mr. Leonard F. Requa, the treasurer and general manager of the company, a good deal of the success of the Safety Company is due and the following named gentlemen, who are always in attendance, have ably assisted Mr. Requa in his endeavors. Ira W. Henry, the electrician of the company, A. P. Eckers, W. E. Halloway, L. S. Taylor, F. H. Richards and F. A. Williams.

THE DALE COMPANY, 22 Thames St., New York City, manufacturers of clamps, pendants, portables, brackets, clusters and fixtures have an attractive booth, the columns and railings being made up of polished brass tubing, such as is used for electric light and gas fixtures. Two good looking youths, dressed in imitation of the immortal Jaggers, the London messenger boy, are in constant attendance. Dale "tells the tale" at this both.

WAGNER ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., represented by their New York and Philadelphia agents, Messrs. John and A. H. Mustard, exhibit a full line of alternating current motors and transformers of every description.

THE COLUMBIA INCANDESCENT LAMP COMPANY'S exhibit is presided over by their New York agents, Messrs. Robert Carey and Oscar Hoppe. They have a beautiful monogram of the company's initials made up of their special lamps and a show case containing every style and application of incandescent lamps.

I. P. FRINK, 551 Pearl St., New York, City manufacturers and patentees of electric light reflectors have a beautiful exhibit presided over by Mr. Frank Stout. The exhibit contains a great variety of imported silk flowers all illuminated with incandescent lamps. Also a full line of their noted reflectors. Mr. Stout should be given great credit for his skill in preparing this exhibit and will always be found at his post of duty.

THE CUTTER ELECTRIC AND MANUFACTURING COMPANY, of Philadelphia and New York, exhibit a full line of their C. S.flush switches and I-T-E automatic magnetic circuit breakers, presided over by their New York agent.

THE ADAMS-BAGNALL ELECTRIC COMPANY of Cleveland, Ohio, exhibit a full line of their arc lamps for all circuits. Mr. C. W. Phipps, eastern manager, will be found at the exhibit at all times ready to explain the virtues of the lamps.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, of Scranton, Pa., have a unique exhibit, the columns forming the front of the booth being composed of dummies representing scientific books.

THE DEY TIME REGISTER COMPANY, of Syracuse, N. Y., have two of their registers on exhibition in their atractive booth, presided over by Mr. C. L. Bennett, their eastern agent, with offices at 23 Dey St., New York City. Mr. Bennett is always at his post of duty and a skillful salesman is he.

L. KATZENSTEIN & COMPANY, 357 West St., New York City, have a fine exhibit of Katzenstein's patent improved sectional self-acting metal packing for steam engines, air and ammonia compressors, etc. This packing is an improvement over the most favored packing now in use. Mr Katzenstein will be found at the exhibit ready to explain the packing in detail.

BRYAN-MARSH COMPANY, 36 Liberty St., New York City, have the most elaborate exhibit as to upholstery, deorations etc., in the Garden. They have one of theirB. & M.photometers in constant operation ready to test lamps for any one desiring the same. They have their lamps displayed in many unique ways on statuettes and on a beautifully sign overhead, showing the name of the company, composed of lamps. Mr. Converse D. Marsh, the president of the company, presides over this exhibit, assisted by R. W. Barnes, the New England representative and other assistants.

THE ORIENT ELECTRICAL COMPANY, of Youngstown, O., Francis Granger, manager of the New York office, Havemeyer Building, 26 Cortlandt St., have an exhibition at the Electrical Show a complete line of their incandescent lamps, from the unique minature lamp to the giant 250 volt lamp. The Orient Giant lamp, made of white material, in the centre of the booth, and illuminated by the colored minature lamps forming the word "Orient" across the face of the same, is one of the striking features of this exhibit. The Orient Electrical Company is supplying most of the exhibitors with lamps and are keeping a complete stock of all kinds of their lamps at exhibit. Mr. Alex. H. Granger is in charge of the exhibit.

EXHIBITION OF THE RADIOPHONE AT THE ELECTRICAL SHOW.

An exhibition of the radiophone, the new wireless telephone by means of which speech is transmitted along a heat ray, was given before an assemblage of invited guests, mainly newspaper men, at the Electrical Exhibition Madison Square Garden, on Saturday afternoon, May 13th.

In the upper gallery at one end of the Garden, was placed an arc light with a parabolic searchlight reflector behind it. As the current was turned on the beam of light was projected to the receiving station at the other end of the Garden, consisting of another parabolic mirror. Part of the current supplied to the arc light was shunted along two wires to an adjacent telephone booth inside of which was placed the telephone transmitter devised by Mr. Hammond V. Hays, of the American Bell Telephone Company. In the centre of the mirror at the receiving end, at the focus of the parabola, was fastened a small glass bulb and from this there extended, through the back

of the mirror and to the ear piece of a phonograph, a short, slender glass tube. On placing the ear tubes in the ear the sounds of the cornet and the voice of the operator in the booth at the sending station could be distinctly heard.

The exhibition was pronounced a big success by all, and general manager Nathan was congratulated upon securing this, with doubt, leading attraction of the show.

AN ELECTRICAL EXHIBITION IN CHICAGO.

An electrical exhibition will be held at Chicago from September 25th to October 9th, at Tattersall's, 16th St., near State. The exposition will be conducted by the National Exposition of Electrical Arts Company which has been organized with a capital stock of $50,000.00, by the following gentlemen, viz., N. J. Heinbach, president; T. Carrabine, secretary, and W. E. Burnham, treasurer and manager. A general electrical exhibition will be given in connection with demonstrations of the latest applications of electricity, such as wireless telegraphy, X-rays, the Nernst lamp, etc., combining features of interest to both the electrical profession and the general public.

THE PHILADELPHIA EXPOSITION OF 1899. FOR THE DEVELOPMENT OF AMERICAN MANUFACTURES AND THE EXPANSION OF OUR EXPORT TRADE.

Of the numerous National and International Expositions projected for the next three or four years in different parts of the United States, the one to be held in Philadelphia in September, October and November of the present year is in many respects the most important to the trade and commercial interests of the country.

The Philadelphia Exposition of 1899 is an exposition for the development of American manufactures and the expansion of our export trade, and it will be the first national exposition of that character ever held in this country.

It is the purpose to exhibit at next fall's Exposition every line of manufactured products of the United States especially suitable for export. Such exhibits will form the principal department of the Exposition and will comprise everything which is, can or might be exported, from locomotives and heavy machinery to the smallest novelties.

There will also be a department of foreign manufactured goods, but it will not contain a single exhibit shown by a foreign manufacturer.

A third department of the Exposition will show how American goods must be packed, labeled and shippped in order to meet the requirements of foreign trade, which vary according to the degree of development or civilization in each country of the world.

In October a Commercial Congress will be held in Philadelphia in connection with the meeting of the International Advisory Board of the Philadelphia Commercial Museum The leading Chambers of Commerce of the entire world have been invited to send delegates and the Commercial Museum has sent out invitations to its agents and representatives abroad to send to the Exposition their buyers or members of their firms. There is every reason to believe that at least 800 representatives of foreign firms will be present at the sessions of the Commercial Congress and in attendance on the Exposition, in addition to the official delegates and those representing commercial organizations.

The Exposition will be under the joint auspices of the Philadelphia Commercial Museum and the Franklin Institute, two great public institutions of Philadelphia, whose standing is such as to insure the success of the Exposition.

Sanction and support has been given to the Exposition by the National Government, Congress appropriating $350,000 to aid it. The city of Philadelphia has given $200,000 and the state of Pennnsylvania $50,000, and $100,000 is being raised in Philadelphia by individual subscriptions. A bill now pending in the Legislature of Pennsylvania apppropriates $200,000 more, making a total Exposition fund of about $900,000.

MISCELLANEOUS.

CONSUMPTION OF COPPER.

The "Tradesman" states that the world's total copper production amounted to 396,728 tons in 1897, and is estimated at 420,000 tons for 1898. By far the greater part of this increase in production is to be looked for in the United States, whose production was 216,000 tons in 1897 and 234,272 tons in 1898. It is particularly interesting to note, as showing the immense development of our electrical industry, that the copper consumption of the United States in 1898 has been more than one-fourth of the copper production of the whole world—viz., 115,935 tons—and that our country has outstripped the leading nations of Europe in industries employing this material.

THE LIGHTING OF THE GREATER AMERICA EXPOSITION.

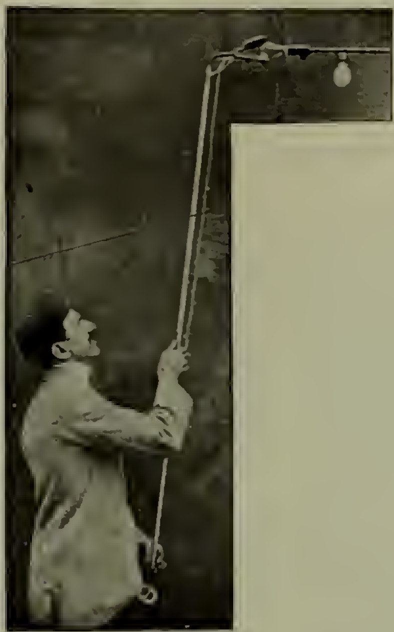
The hitherto unequalled illuminations of the grand court of honor during the Trans-Mississippi exposition will be admirably outshone by the electrical novelties and effects now being prepared by skillful electricians for the Greater America Exposition at Omaha, Neb., which will open its gates July 1st and continue for four months. Over 15,000 new lights are being placed upon the great main buildings alone, whose grand proportions will be completely outlined in flaming curves and angles, and many startling effects never shown before in outdoor electric illumination are being provided. Last year's illuminations excited the warmest admiration of all visitors, but a marvelous revelation awaits visitors to the first Great American Colonial Exposition.

A GERMAN CABLE TO AMERICA.

The German rubber industry, which for many years was naturally under tutelage, has so completely emancipated itself that last year the foreign imports of rubber wares of all kinds did not represent more than six per cent. of the home production. This figure is all the more significant, argues the "Gummi Zeitung," since half of the six per cent. concerns shoes and slippers, which nothing but old-established prejudice insists upon having with the fashionable foreign mark. Whether that be so or not, does not interest us. Anyhow, almost two million pounds sterling of raw material seem to have been turned into wares of every variety which find a market in the country and abroad. The value of the rubber exports is estimated at about 1,500,000 pounds. Under the circumstances it is not astonishing that a direct cable is to be laid between Germany and the United States. The firm of Felten and Guilleaume, of Mulheim-on-the-Rhine, which enjoys an excellent reputation is said to have, for some time already, held a concession from the Government. A company is now being formed. Its seat will be at Cologne, and the new cable works will be at Nordenham, on the North Sea. Noteworthy among the export fields of German rubber is Japan, a country which will not really be ready to compete with Europe in this branch for some time to come.—Ex.

THE INCANDESCENT ELECTRIC LIGHT MANIPULATOR AND CLEANER.

An interesting appliance for readily renewing and cleaning incandescent lamps has been placed on the market and can be seen in actual operation at the electrical Exhibition at Madison Square Garden. In the illustrations the general appearance and method of applying this device is shown. It consists of a long supporting piece



View Showing How Manipulator is Operated.

with a ratchet and catch with rope attached at one end and a pair of soft clamps at the other end. By manipulating the ratchet device at the bottom the cord connecting to it is pulled and the clamp opened to receive the incandescent lamp bulb. The clamps are bare if used for screwing or unscrewing the lamp but are covered with heavy cloth cleaners if they are meant to be applied for cleaning

Manipulator in Operation.

purposes. These heavy cloth cleaners are removable. In handling the electric-light manipulator a little care and judgement is required which will rapidly accustom the operator to a full and comprehensive knowledge of its use. Unless the lamp is absolutely jammed into the socket frozen fast, as it were, the manipulator can be fully relied upon to remove it. It represents a piece of mechanism absolutely indispensable to public buildings, office buildings, theatres, churches, residences, etc. Mention must be made in ordering of the system used and whether manipulator is to be applied for outdoor or indoor lamps. Also other details regarding the distance of lamps above the floor, etc. The manipulator is manufactured by the Incandescent Electric Light Manipulator Company, of 116 Bedford St., Boston, Mass.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.
TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING MAY 2, 1899, $107,569.00.

New York, N. Y., May 2, 1899.—The following exports of electrical material, machinery, etc., are from the port of New York for the week ending this date:—

Antwerp:—31 cases of electrical material $1,038.

Argentine Republic:—80 cases electrical material $1,679. 23 packages electrical machinery $2,187.

Alexandria:—22 packages electrical machinery $7,099.

Amsterdam:—3 packages electrical material $150.

British East Indies:—5 cases electrical material $183.

Barcelona:—35 cases electrical material $714.

British West Indies:—6 packages electrical material $124

British Australia:—16 packages electrica 1 material $327

Bremen:—6 cases electrical material $156.

Berlin:—14 cases electrical material $2,572.

Brazil:—14 packages electrical material $634.

Brussels:—1 case electrical material $40.

Chili:—87 cases electrical material $2,572.

Central America:—1 package electrical material $23.

Copenhagen:—8 packages electrical material $109.

Cuba:—35 cases electrical material $1,253.

Genoa:— 1 case electros $1. 2 cases electrical material $23.

Hamburg:—48 packages electrical material $3,394. 5 cases electrical machinery $310.

Helsingfors:—3 cases electros $66.

Havre:—206 packages electrical machinery $19,817. 112 cases electrical machinery $2,997. 11 cases electrical machinery $750.

Hong Kong:—23 cases electrical material $300.

Japan:—17 cases electrical material $2,413.

London:—170 cases electrical material $5,766. 1 case electros $17.

Liverpool:—24 cases electrical material $985.

Mexico:—132 cases electrical material $914. 55 cases electrical machinery $14,150.

Marseilles:—50 packages electrical machinery 425.

Milan:—7 cases electrical material $384.

Manchester:— 11 cases electrical material $1,760.

New Zealand:—16 packages electrical material $426. 4 cases electrical machinery $442.

Porto Rico:—17 packages electrical material $541.

Peru:—6 cases electrical material $248.

Southampton:—38 packages electrical machinery $370

Southampton:—38 packages electrical machinery $370.

Siam:—9 cases electrical material $377.

Stettin:—133 cases electrical machinery $28,867.

U. S. Columbia:—3 cases electrical material $60.
Venezuela:—57 cases electrical material $704.
Zurich:—30 cases electrical material $1,574.

NEW INCORPORATIONS.

Brooklyn, N. Y.-Diagnostic Electric Lamp Co., incorporated by John W. Morrison, E. P. Reiss and J. Felsenstein; electric goods. Capital stock $25,000.

Bluefield, W. Va.—The East River Electric Co., has been organized with Edward Mann President; W. A. Cather, Vice-President; W. F. Hawley, Secretary and Treasurer.

Richmond Va.—Tower-Binford Electric & Mfg. Co., incorporated by P. H. Mayo, George A. Tower and others. Capital stock $100,000.

Bangs, Va.—Unique Power, Light & Water Co., incorporated by James Rigby, Belle Rigby, James Rigby, Jr., and others. . Capital stock $10,000.

Denver, Colo.—The Denver Gas and Electric Co., incorporated by Elroy N. Clark, Herman H. Dunham and Charles W. Waterman. Capital stock $3,500,000.

South Bethlehem, Pa.—South Bethlehem Electric Light Co., incorporated by Charles P. Hoffman, William H. Lauer, and others. Capital stock $30,000.

Jersey City, N. J.—National Light and Power Co., incorporated by Karl R. Miner, Frederick L. Austin, and others; manufacture chemical electrical batteries, etc., Capital stock $15,000,000.

East Orange, N. J.—Union Gas and Electric Co., incorporated by Richard S. Stoors McKee D. McKee, and others. Capital stock $1,250,000.

Cornelsville, Pa.—Youghiogheny Light Heat & Power Co., incorporated by Sam'l Slaymaker, Jos. Soissons, and others. Capital stock $15,000.

Manistique, Mich.—Manistique Light Co., incorporated by G. H. Orr, V. P. Chapple, and others. Capital stock $20,000.

Camden, N. J.—O'Neill & Rooney Electric Asepsis Co., incorporated by D. Morton Bond and others. Capital stock $250,000.

Trenton, N. J.—The National Electric Co., incorporated with a capital stock of $25,000,000; to produce and deal in coke, gas, electricity, etc.

TELEPHONE CALLS.

Binghamton, N. Y.—Binghamton Telephone Co., incorporated by Thomas B. Crary and others. Capital stock $100,000.00.

Jackson, Mich.—The Peninsular Telephone Co., incorporated by V. B. Osborn and others. Capital stock $20,000.

San Francisco, Cal.—Western Automatic Telephone Exchange Co., incorporated by Scott Calhoun, Andrew White and others.

Piqua, Ohio.—Piqua Home Telephone Co., incorporated by L. M. Frerh, H. K. Wood, J. L. Prugh, H. T. Dittman, S. Boal, and others. Capital stock $75,000.

New Bremen, Ohio.—New Bremen Telephone Co., incorporated by T. Purpus, E. Purpus, A. C. Burr, and others. Capital stock $6,000.

Far Rockaway, N. Y.—Seaboard Telegraph & Telephone Co., incorporated by J. Carl Schmuck, Andrew McTighe, and others; telegraph and telephone lines. Capital stock $50,000.

Frankfort, Ky.—The Frankfort Telephone Co., incorporated by W. W. Longmoor and others. Capital stock $10,000.

Chicago, Ill.—American Telephone Co., incorporated by George H. Taylor, Albert Martin, and George C. Wilder. Capital stock $2,500.

Brimfield, Ill.—Brimfield Telephone Co., incorporated by Addison Pacey and others. Capital stock $500.

Lawrence, Mass.—Home Telephone & Telegraph Co., incorporated by Edwin W. Burton and others. Capital stock $100,000.

Akron, Ohio.—People's Telephone Co., incorporated by Will Christy, J. R. Nutt, and others. Capital stock $150,000.

Stockport, Ohio.—Morgan County Telephone Co., incorporated by C. H. Foutz, T. J. Lyne, and others. Capital stock $10,000.

Circleville, Ohio.—Circleville Telephone Co., incorporated by Charles E. Groce, Wm. T. Bell, and others. Capital stock $10,000.

Kirksville, Mo.—Kirksville Telephone Co., incorporated by J. M. Kennedy, J. C. Storm, and others. Capital stock $14,000.

Trumbull Corners, N. Y.—Trumbull Corners Telephone Co., incorporated by J. D. Smith and others. Capital stock $300.

STREET RAILWAY NEWS.

Stockport, Ohio.—Central Ohio Electric Railway Co., incorporated by John J. Dun and others. Capital stock $10,000. Will conduct business at Columbus, Ohio.

St. Louis, Mo.—Maplewood & Jefferson Barracks Railroad Co., incorporated by Joseph T. Donovan, John E. McDermott, and others; electric railway. Capital stock $100,000.

POSSIBLE INSTALLATIONS.

Augusta, Ga.—Paul Langdon and others, and the Augusta Light, Heat & Power Co., have each applied for franchise for the establishment of gas and electric plants.

Gainsville, Ga.—D. E. Evans proposes the erection of an electric light plant.

BUSINESS CHANGES.

Chicago, Ill.—The Montrose Electric Co., has changed name to Montrose Electric Co.

JOTTINGS.

ABENDROTH & ROOT MANUFACTURING COMPANY have moved to the handsome new office building at No. 99 John St., corner Gold, New York City. They occupy a handsome suite of rooms with plenty of light and air and—last but not least—plenty of business in Root tubular boilers.

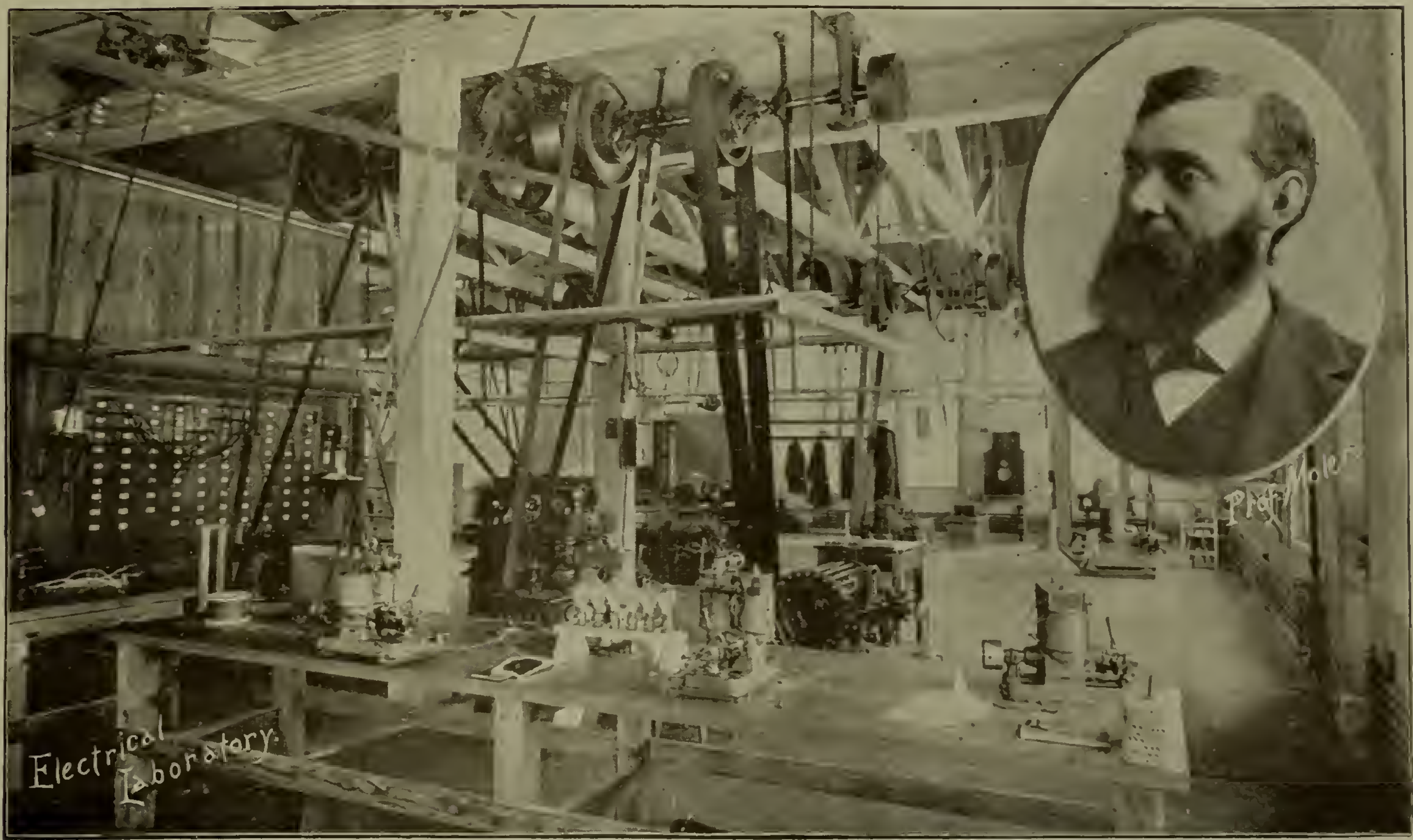
H. McL. HARDING, formerly manager of the sales department of the Walker Company, at 22 Broad St., New York City, has returned from a four months pleasure tour on the Continent. Mr. Harding was looking well and enjoying the sights and scenes at the Electric show the other evening, accompanied by his wife. We expect to see him settled in his new enterprise shortly.

THOMAS POWERS, better known among the trade as Tom,—Fred. Pearce's hustler,—is securing a number of large orders among the principal hotels in Greater New York for fire alarms. Mr. Powers is feeling very proud of Mr. Pearce's new quarters,—a floor 200x40 feet square,—at Nos. 18-20 Rose St., New York City.

The Electrical Age.

Vol. XXIII—No. 20 NEW YORK, MAY 20, 1899 Whole No. 627

EDUCATIONAL.



Electrical Laboratory at Cornell University.

ELECTRICAL ENGINEERING AT CORNELL UNIVERSITY.

This wel known institution, situated on the eastern slope of the Cayuga Lake Valley, New York State, is one of the representative technical colleges in this country. Profs. Moler and Ryan of the electrical engineering course have given instruction to some who have become well known experts. The dynamo laboratory of this university of which a view is shown is believed to be the largest college dynamo room in this country, if not in the world. It contains no machines that are used in regular lighting service but is devoted entirely to the experimental study of dynamos and motors. The floor space is forty by seventy feet. The collection of dynamos includes nearly all the well known types together with many machines of unusual form, constructed especially for experimental purposes. These machines are of various sizes, from twenty horse power down and they are arranged with special reference to the requirements of experimental work.

An important part of the work in applied electricity, electrical measurements together with a detailed study of storage batteries, arc lamps, meters, etc., is carried on in the annex to Franklin Hall which is a substantial one story building, one hundred by thirty-seven feet. Operations of extreme precision are conducted in the magnetic observatory, an isolated building entirely free from iron, containing galvanometers and other standard instruments. The more practical part of the electrical work is in charge of Prof. Ryan, the author of several well papers on electricity. For students up the State the town of Ithaca is situated in a most convenient location. The Sibley College of mechanical engineering of Cornell University is under the supervision of Prof. R. H. Thurston, who is also director.

TECHNICAL NOTES.

*ON A DIRECT CURRENT DYNAMO WITHOUT BRUSHES.

By Albert Campbell, B. A.

It has often been laid down as a fundamental principle that it is impossible to construct a dynamo to give an unidirectional current without slipping contacts somewhere or other in the machine. And this principle seems reasonable enough when we consider the two possible cases that arise. In the first case a part of the corcuit moves so as to go on cutting lines of force in the same direction. As an example of this may be mentioned Lorenz's apparatus, in which a conducting disc is rotated in its own plane at right angles to a magnetic field. It is obvious that slipping contacts are here absolutely necessary. In the second case a part of the circuit (which we may call a coil) is so arranged that it becomes interlinked with a varying amount of magnetic flux. Now, every time the flux attains a maximum value the E.M.F. induced in the coil changes sign, and accordingly at that moment the coil must be commutated with regard to the main circuit, for if not we should obtain an alternating current. So in this second case commutation is essential, and therfore it would seem slipping contacts must be used here also. But this does not follow, for, as I now proceed to show, commutation can be obtained without any sliding contact whatever, and with all parts of the conducting circuit quite rigidly connected together.

Let P M Q M in fig. 1 be a Wheatstone's bridge in

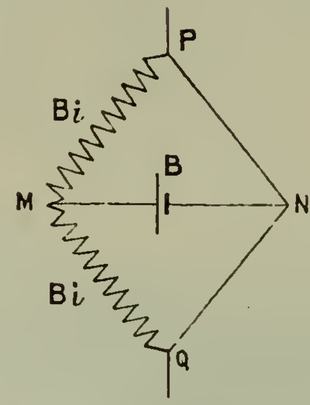


Fig. 1.

which B is a battery or other source of continuous current, and let the four arms be of equal non-inductive resistance, but two of them, P M and M Q, of pure bismuth.

Since the bridge is balanced, there will be no potential

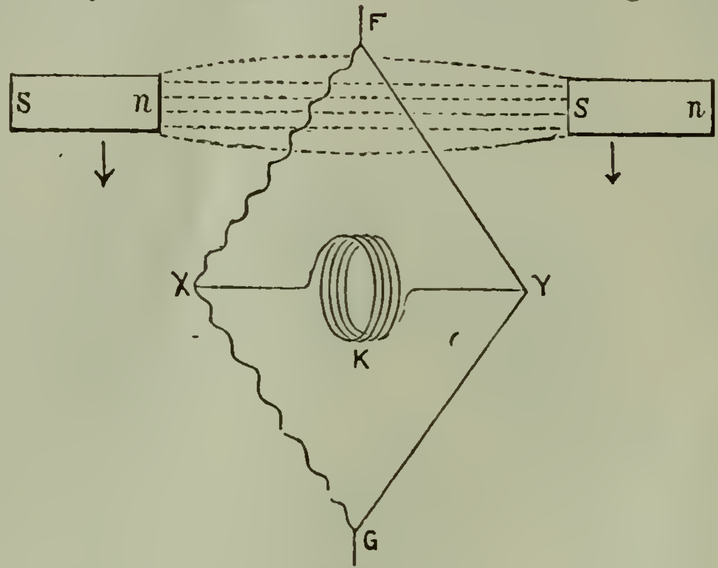


Fig. 2.

difference between P and Q. Now let a strong magnetic field cut alternately the two bismuth arms. When either arm is in the field its resistance is largely increased, and the bridge is thrown out of balance; we thus obtain an alternating potential difference from P to Q. From

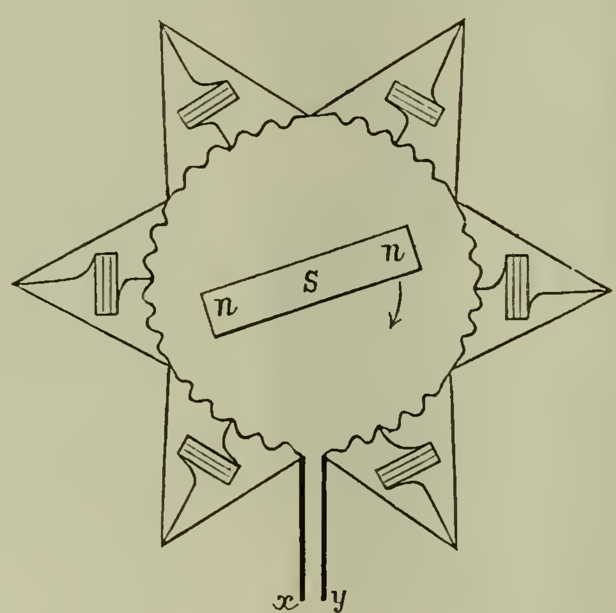


Fig. 3.

this simple case we can easily pass to the converse one where a source of alternating E.M.F. is made to give a unidirectional current.

This case is shown in fig. 2, in which the bridge arms are the same as in figure 1, but the battery is replaced by

*London Electrical Review.

a coil K with its plain perpendicular to the plane of the paper. If the magnetic flux shown in the figures now moved downward from F to G and be followed at a distance equal to FG by a series of similar fluxes an alternating E.M.F. will be set up in the coil K. Owing to the action of the bismuth arms however a unidirectional difference of potential will be produced from F to G and a rectified current may be taken from these points. To obtain a uniform continuous current it will only be necessary to connect in series a sufficient number of such elements as shown in fig. 3 and to dispose the rotating magnets that the pulsating E.M.Fs. produced by the several elements should be progressively out of phase with one another and so produce a steady potential difference at XY.

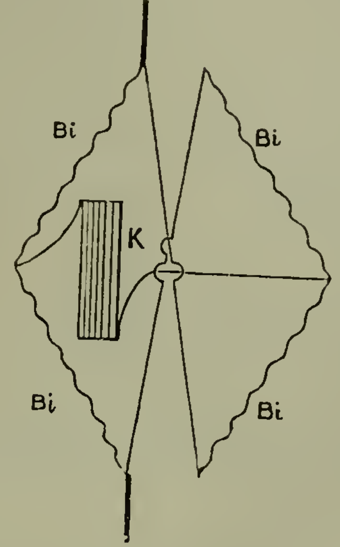


FIG. 4.

To get more efficient commutation all four bridge arms should be of bismuth and they should be placed as in figure 4 so that pairs of opposite arms may be in the magnetic field at the same time.

Let us now consider whether it is possible to obtain really efficient commutation in this way. If the bridge arms are of pure electrolytic bismuth at ordinary temperatures a flux dencity of about 14,000 would alter their resistances by about 60 per cent. In the most favorable case where the coil K, figure 2, is of negligible resistance the rectified voltage available from F to G would for B—14,000 be less than one-fourth of the alternating E.M.F. induced in the coil. If very low temperatures could be used the available fraction would be much larger for the resistance changes in the bismuth would then be enormously increased.

The peculiar properties of bismuth in a somewhat similar way afford a means of obtaining rectified current from an alternating one without the use of moving circuits. In figure 5 is shown a simple arrangement which gives a partially rectified current.

A strong permanent magnet is placed with one pole close to one of the poles of an electro magnet E m excited by an alternating current from A. A bismuth strip B i through which this current also passes is placed between the facing poles and in parallel with the strip is a circuit consisting of a choking coil of low resistance and a moving coil galvanometer G. If the permanent magnet is strong enough the magnetic flux through the bismuth strip never changes sign and the strip will have a higher resistance for one-half of the alternating current wave than for the other, the result being that a partially rectified current will be sent into the galvanometer circuit. Even with ordinary commercial bismuth in which the resistance changes are relatively small it is easy to get a deflection on the galvanometer which changes in direction when the permanent magnet N S has its position reversed. The choking coil serves to keep back much of the alternating component. This action of an impedance coil upon a pulsating current is worth a little further consideration. Figure 6 illustrates the effect of increasing the impedance of a circuit of fixed resistance which has a constant pulsating P. D. at its end.

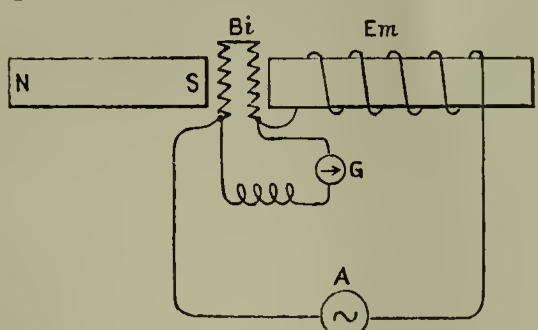


FIG. 5.

The curve A represents the current when the circuit is non-inductive, b shows the ripples partially smoothed out by adding moderate self inductance while c shows the result by adding very high inductance, namely a practically continuous current. It should be noticed that the continuous current obtained is exactly equal to the mean value of the original pulsating current although the values of their mean squares would be very different. The above experiment is a very instructive one and the result shows that in some practical cases impedance may be increased with advantage. Doubtless when rectified currents are used for arc lighting the series coils in the lamps help to smooth out the current ripples and lessen the flickering effect noticeable at the lower frequencies. Unfortunately however it is the high frequency ripples that are most easily smoothed out.

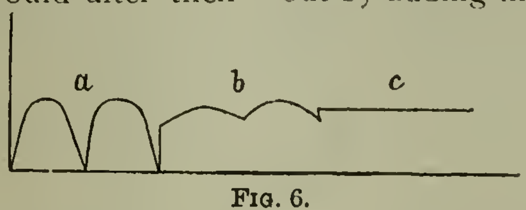


FIG. 6.

The arrangement shown in figure 5 does not give purely unidirectional currents but these may be obtained from

alternating ones by applying the principle there used to one or more of the arms of a Wheatstone's bridge.

Although these methods of rectifying alternating currents are probably of little use in commercial applications, owing to their low efficiency, it is possible that they may prove useful in connection with the measurement of certain alternating current quantities; in any case they form instructive lecture room experiments.

It is easy to see that in the arrangement shown in fig. 3, instead of using bismuth, copper wires might be employed, which should have their resistances varied by a gas flame rotating with the same speed as the magnet.*

To return, in conclusion, to our main proposition, it is evident that commutation can be obtained without slipping contacts, i. e., in absolutely fixed circuits, by means of alterations in resistance produced by magnetic, thermal, or other means.

GROUNDS AND SHORT CIRCUITS.

In electric light work partial grounds, dead grounds and short circuits are frequently met with. In figures 1, 2, 3 and 4, are shown methods of testing for each respectively. In figure 1 we have the case of dead ground. The upper wire of this circuit is in metallic contact with a gas pipe, water pipe, etc. In consequence of this a lamp placed between the other wire and the grounds lights up brightly. In figure 2 we have a case of partial ground, one in which it is necessary to test more for a failure in insulation than actual metallic contact. A Wheatstone bridge is employed, as shown. In figure 3 a short circuit is shown which can be easily indicated by the presence of a lamp in the line. In figure 4, a short circuit in a branch is indicated in a similar manner.

*As I have only discussed circuits with fixed rigid conductors, I have omitted all mention of electrolytic methods of rectifying alternating currents.

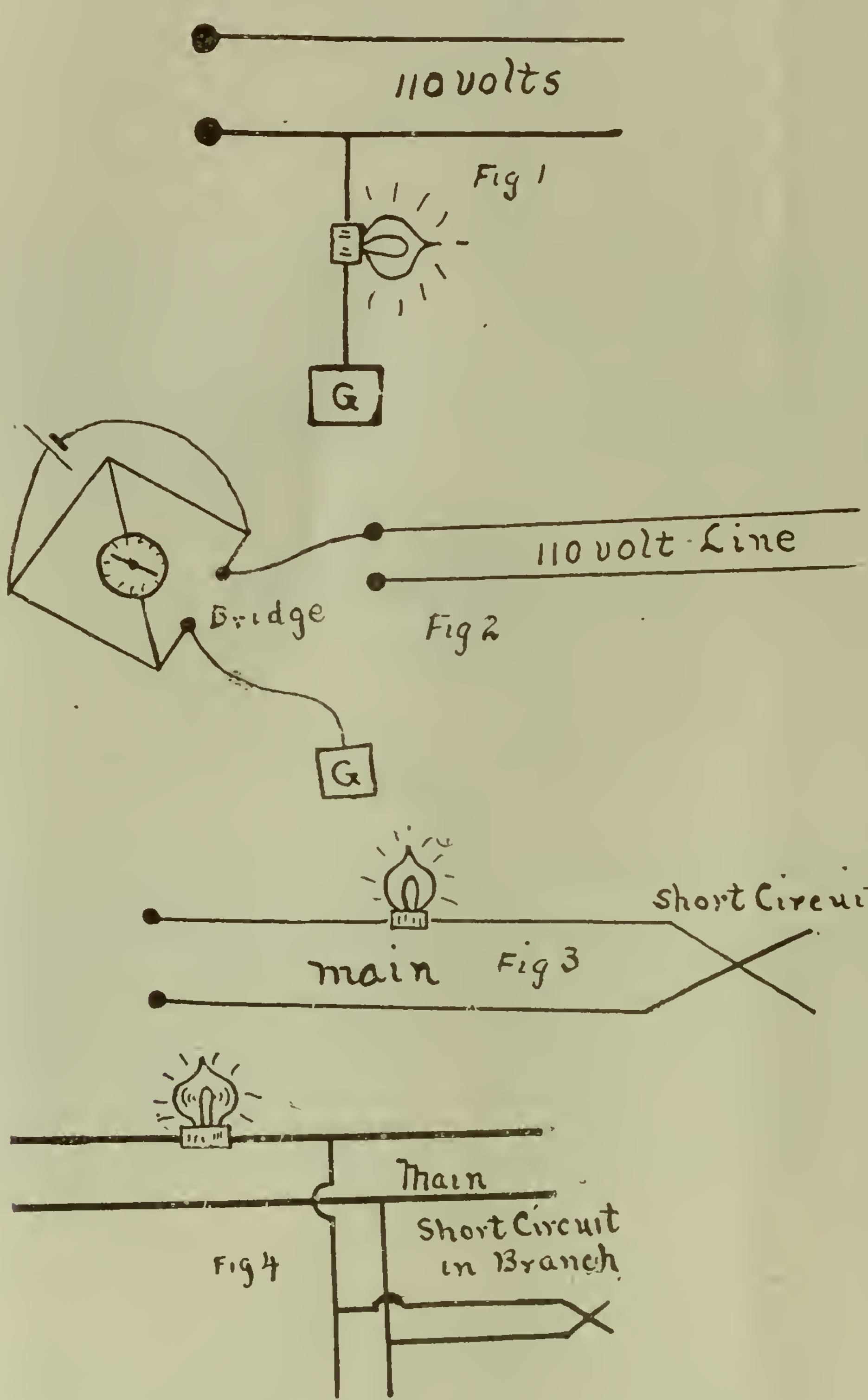


Diagram Showing Grounds and Short Ciruits.

The Case Manufacturing Company, Columbus, Ohio, has lately shipped a 15-ton electric travelling crane to St. Petersburg, Russia, for use in a new port at that place: also two 30-ton three motor electric travelling cranes for use in the government powder station at Sydney, New South Wales.

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CONTENTS. PAGE

THE TRANSPORTATION PROBLEM IN LARGE CITIES.

The problem of transportation in large cities has become the subject of the day, particularly in Greater New York. In the "Journal of the Franklin Institute" Mr. Edward E. Higgins, makes some very interesting statements and discusses the subject analytically. He divides it up into the problem of cars and car service; the problem of track and road bed; the problem of fares, transfers, etc. He shows in a most interesting manner that the companies owning and operating the surface roads are dealing with the theory of probabilities, depending, to a large extent, as the insurance companies do, upon each passenger travelling only a limited distance for his five cents.

He states: "for five cents a citizen of Brooklyn may travel more than ten miles. A citizen of any of our great cities can travel ten, fifteen or even twenty miles. In doing so he inflicts a loss upon the company and if there were a large proportion of the total number of passengers carried who travelled so far or even five or ten mile distances our city railway properties would be continually unprofitable and probably insolvent. It is in the short distance riding that the losses are made up and it must therefore in frankness be admitted that the short distance rider pays part of the fare of him who rides a longer distance. This is an apparent injustice which cannot, however, be remedied unless the whole principle and policy of American street railroading be radically changed and the effect of the change would be undoubtedly disastrous from a sociological point of view, tending to check the expansion of cities to the suburbs and increase the congestion of life in the centre

Is the present five cent fare too high and can it be reduced without consequent disasters to street railway companies? Both these questions can be most emphatically answered in the negative. The street railway companies of to-day are giving to their patrons a maximum ride two or three times greater than that given for the same price ten years ago and an average ride at least fifty per cent. greater; they are giving them a speed in transit from fifty to one hundred per cent. greater; and are providing them with cars cleaner finer, better lighted and in all respects superior to the old regime. Is a mere change of motive power from horses to electricity a magical thing that can multiply wealth as by a philosopher s stone? No. The street railway companies of the country are by no means unduly prosperous to-day. In fact, too many of them are struggling under far heavier burdens than ever ought to have been put upon them by the people. In Philadelphia ,for example, the right to change the motive power from horses to electricity has been granted on condition that the street railway company shall lay down new pavement and permanently maintain this pavement on over four hundred miles of streets within the city limits—a condition more enormous perhaps than that ever before laid upon a quasi public industry and one which will make the payment of excessive dividends or a reduction of fares impossible for many years to come, if not forever."

From this standpoint it is certainly evident that the transportation problem in large cities is one which is assuming such magnitude that it will become absolutely necessary for the municipality to ease the burden carried by those whose business it is to provide conveniences of travel for those living within the city limits. It may be that in the future when the burden becomes too heavy and possible bankruptcy confronts those whose investments are involved in schemes of this description that the city will be forced to either buy out or partially support street railway corporations. The wisest policy may be that of owning the surface roads, as the mail system in this country and the telegraph in Great Britian is controlled by the State. Our American cities are not growing smaller but larger and in those of the most cosmopolitan character the ever increasing cry for better facilities in transportation, for more rapid transit, may force not one but all to run their own surface roads. A matter of this kind so dovetailed in with the every day life of each man cannot be disregarded by the ruling body of citizens for investigations have repeatedly shown that the burden of debt carried by street railway corporations in spite of their increased capitalization is growing heavier and heavier Someone has already suggested that the tax on private property be increased to such an extent that every citizen within the city limits can travel free, so to speak, on the surface roads. The city taxes the houseowner for water, it taxes him for the ground and home he occupies, it imposes a tax upon him for the use of the post and there is no reason, if direct benefit has been derived from such a system, why the city should not regard this problem as one similar and allow every citizen living within the city limits to forget that he once paid fare. If Brooklyn Bridge were leased to a private corporation a hue and cry would be raised against such a proceeding, yet there is but a slight difference between the leasing of public streets and the leasing of a gigantic structure like the Bridge, which is really one of the pathways between New York and Brooklyn.

Alexandria, Minn.—The Park Region Telephone Exchange Co. has been incorporated by George G. S. Campbell, N. L. Page, Tolef Jacobson, Rudolph Wegener and Fred D. Campbell. Capital stock $10,000.

AMONG THE SOCIETIES.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION.

Every member of the electrical fraternity is preparing for the coming convention of the National Electric Light Association, the preliminaries of which will soon be completed. The convention days wil be May 23rd to 25th and the programme followed out will be that indicated below.

The discussion on "Transformers" wil be led by Professor Goldsborough, of Purdue University, Lafayette, Indiana.

Several topics of great interest to central station managers will be discussed; subjects to be announced later.

THE GENERAL ELECTRIC COMPANY has extended an invitation to the active members of the Association to visit their factories at Schenectady, and they have arranged for a special train via New York Central Railroad, to leave the Grand Central Station on the morning of May 26th, reaching Schenectady in time to give all the afternoon for visiting the works, and arriving at the Grand Central Station again at about ten o'clock the same evening.

THE MURRAY HILL HOTEL has been selected as the headquarters of the Association. Hotel rates will be: on the American plan, $3.50 and upward per day; on the European plan, $1.50 and upward per day, according to room.

A. M. YOUNG,
President National Electric Light Association.

Papers on the following subjects will be read and discussed: "Single-Phase Distribution," Herbert A. Wagner, St. Louis, Mo.; "Underground Electrical Construction," Louis A. Ferguson, Chicago, Ill.; "Some Notes On Underground Distribution Of Two-Phase Current In New York City," E. A. Leslie, New York City; "The Development Of High-Tension Service," (Illustrated by Stereopticon), Calvin W. Rice, New York; "A Local Transmission System-Development And Operation," W. S. Barstow, Brooklyn, N. Y.; "Alternating-Current Generation And Distribution-Changes Contemplated In Atlanta," H. M. Atkinson, Atlanta, Ga.; "Means of Affording Safety In Electrical Distribution," W. L. R. Emmet, Schenectady, N. Y.; "Rotary Transformers And Storage Batteries, And Their Relation To Long-Distance Transmission," Professor W. L. Robb, Hartford, Conn.

TRANSPORTATION—The Trunk Line Association, The Central Passenger Association, The Southeastern Passenger Association and The New England Passenger Association have granted a rate of a fare and one-third, on the certificate plan, from points in their territory and return, for delegates and friends attending the twenty-second convention of this association, to be held in this city May 23, 24, 25. The following gentlemen will have charge of transportation matters for their several localities:

Mr. W. Forman Collins, 510 Marquette building, Chicago, Ill.; Mr. H. A. Wagner, Missouri-Edison Company,

St. Louis, Mo.; Mr. C. F. Hesser, Cincinnati Gas Light and Coke Company, Cincinnati, O.; Mr. Morris W. Mead, City Electrician, Pittsburg, Pa.; Mr. R. F. Ross, 620 Atlantic Avenue, Boston, Mass.; Mr. H. B. Cutter, 1112 Sansom St., Philadelphia, Pa.; Mr. S. C. D. Stern, City Electrician, Denver, Colo.; Mr. H. M. Atkinson, Georgia Electric Light Company, Atlanta, Ga., and Mr. E. R. Weeks, Kansas City Electric Light Company, Kansas City, Mo.

THE ELECTRICAL EXHIBITION to be held under the auspices of the Association opened at Madison Square Garden on May 8th, and will continue until June 3d.

This exhibition will show the development of electricity in all its branches, at the close of the nineteenth century. Particular attention will be given to the advancement in electric-lighting apparatus. One interesting exhibit will show the improvement in the arc light, showing step by step, the advancement made from the Jablochkoff candle to the modern lamp.

Two of the special features of the exhibition will be experiments with wireless telegraphy and with liquified air.

C. O. BAKER, JR.,
President Electrical Exhibition Company and Master of Transportation National Electric Light Association.

There will also be the finest display of automobiles ever made in this country.

Passes to the exhibition will be issued to members of the Association and delegates attending the convention, upon application to the Secretary.

Committees have been appointed by President Young as follows: Reception Committee—Thomas E. Murray, chairman, Chas. A. Schieren, H. L. Shippy, C. H. Jack-

MARCUS NATHAN,
General Manager Electrical Exhibition Company.

C. R. Huntley, Ex-Pres. N. E. L. A.

C. O. Baker, Jr, Master of Transportation

S. M. Hamill, Brush Electric Co.

Elihu Thomson, Gen. Elec. Co.

Edwin J. Houston, Author and Expert.

A. H. Brooks, Am. Cir. Loom Co.

A. Kennelly, Author and Expert.

F. Nicholls, Ex-Pres. N. E. L. A.

W. T. Candee, Okonite Co.
P. McQuaide, Nat'l Conduit & Cable Co."

C. H. Wilmerding, Ex Pres. N. E. L. A.
W. J. Godfrey, Habirshaw Wire Co.

Samuel Insull, Past Pres. N. E. L. A.
E. F. Peck.

Geo. F. Porter, Sec. N. E. L. A.
C. D. Shain, Siemens & Halske.

J. A. Seely.
H. L. Shippy. Roebling Sons & Co

Popular Faces at the N. E. L. A. Convention.

son, L. F. Requa, Geo. T. Manson, J. W. Lieb, Jr., Paul Spencer, E. A. Leslie, E. H. Stevens, William Brock, E. H. Maher, Jr., A. J. Purinton, A. H. Patterson, and W. S. Barstow, Entertainment Committee—Chas. W. Price, chairman, W. L. Candee, Theodore Beran, Wm. F. Zimmerman, C. O. Baker, Jr., A. H. Patterson, E. F. Peck.

A steamboat excursion up the North River to Yonkers will give the ladies an opportunity to view some of the sights in and around Greater New York.They will pass the Palisades, circle around the Navy Yard, etc., and then have luncheon on board the boat.

On Wednesday, May 24th, in the afternoon an automobile ride for the fairer sex will start from the Garden, the committee in charge of same being:

Columbia University will be visited and the route will cover Fifth Ave., Grant's Tomb, Riverside Drive, etc. Tea will be served in the West Hall of Columbia University. The library, electric plant, engineering departments, etc., will be inspected. After this the stables of the New York Electric Transportation Company will be visited for the purpose of seeing how electric cabs are groomed and fed.

The last convention of the National Electric Light Association was held at Chicago June 7, 8 and 9, 1898. Business of considerable importance was transacted and papers read relating to electric light and power. The Association has added to its prosperity year by year and extended its membership list so as to include all electric light men of any consequence in the United States. The interest attached to meetings of this kind has increased until, now wherever the association holds its convention the citizens of that town regard it as a municipal event.

Papers read by the appointed members of the association are written by men that have had an intimate experience with the subjects it is their privilege to discuss. The papers contained within the transactions of sister societies that are supposedly of a more technical and scientific nature will be found by comparison to be, if anything, only on a par with those delivered before the National Electric Light Association. The position which the association holds among the electrical fraternity is a most unique one. The members are well known to each other and in many respects have grown up together so that the ties binding each to each are of the strongest character from a social standpoint. The diversity of experiences enjoyed by those constituting the delegates enables them at convention meetings to provide an entertaining and instructive meeting. At the last convention but one at Niagara Falls the entire field of work was covered in so interesting a manner that many members waited with impatience for the next gathering. The N. E. L. A. conventions offer two great advantages to those attending them: increased opportunities for the transactions of business and a means of acquiring information of the highest practical value.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 16th annual business meeting of the institute was held at 12 West 31st St., on Tuesday May 16th, at which the annual reports of the Council and Treasurer were presented. The total membership on May 1st was 1,133 being a net gain of 35 during the year. All debts were reported paid. The cash balance in various funds amounted to $5,702.74. and other assets $5,067.75. The counting of the ballots showed the election of the Council nominees, 321 complete ballots cast. For President: A. E. Kennelly, 306. Vice-Presidents, J. W. Lieb, Jr., 304, Chas. F. Scott, 304, L. B. Stillwell, 302. Managers, C. O. Mailloux, 294, S. Dana Greene, 309, C. S. Bradley, 314, W. D. Weaver, 311. For Secretary, R. W. Pope, 320. Treasurer, Geo. A. Hamilton, 321.

A paper was presented by Frank J. Sprague, Past-President, on the "Multiple Unit-System of Electric Railways" which was fully illustrated by a working model and lantern slides.

This paper was discussed by John B. Blood, Jr., A. H. Armstrong, H. Ward Leonard, F. V. Henshaw and others.

At the meeting of the Executive Committee in the afternoon the following members were elected:—Louis E. Bogen, 547 Hale Ave., Avondale, Cincinnati, O.; Paul Bonynge, 104 Berkely Place, Brooklyn, N. Y.; Joseph H. Bowman, Chihuahua, Mexico; Ellis Eugene Brown, Kingston, Pa.; Walter E. Chappell, Barnesville, O.; Louis A. Herdt, McGill University, Montreal, Canada; Albert C. Johnson, Box 7, Wilmar, Minn.; Thos. J. Johnston, Schnectedy, N. Y.; John F. Kelly, Pittsfield, Mass.; Chas. Edwin Knox, 108 W. 122nd St., New York, N. Y.; John F. McCartney, 53 Victoria St., London, Eng.; Robert D. McCarter, Jr., Schenectedy, N. Y.; Robert McClenathen, Box 476, Ithaca, N. Y.; A. Center Middleton, Box 253, Schenectedy, N. Y.; E. H. Mullin, 188 Columbus Ave., New York; Harry Nathan Ramsey, 1062 Lexington Ave., New York City; Geo. P. Robinson, Milwaukee, Wis.; Frank Robert Schoolfield, 10 Clifton St., West Somerville, Mass.; Chas Ralph Sturdevant, Lexington, Ky.; S. E. Whiting, 11 Ware St., Cambridge, Mass.

EXHIBITIONS.

ELECTRICAL EXHIBITION NOTES.

CROCKER-WHEELER ELECTRIC COMPANY, 39-41 Cortlandt St., New York City, have an excellent exhibit of their noted dynamos and motors. In the centre of the booth is an immense 400 K. W. multi-polar generator, standing about ten feet high. This booth is presided over by F. S. Blackall, of Messrs. Blackall, the selling agents, 39 Cortlandt St., New York City, assisted by a number of their able salesmen.

GOLD STREET CAR HEATING COMPANY, Frankfort and Cliff Sts., New York City, show a full line of their electric heaters, both portable and stationary.

JOS. DIXON CRUCIBLE COMPANY, of Jersey City, N. J., exhibit a full line of their graphite products for electricians and the electrical industries. They exhibit a useful line of products showing all kinds of graphite resistances. The are just bringing out a new line of pencil carbons. Mr. Beard, better known as one of the square men of the Electric Show, presides at this booth. The illumination of this booth is one of the attractions of the show, three Eschwei enclosed arc lamps being placed in an enclosed sign with the word "Dixon" on the face of the same. They have an ingenious automatic switch operated by an ordinary metal clock which cuts the light in and out every ten seconds. The Eschwei lamp is the product of the Universal Electric Pull Socket & Switch Company, of New York City.

AMERICAN CIRCULAR LOOM COMPANY, of Chelsea, Mass., shows a complete line of their two interior conduits, electro duct and circular loom. In connection with their exhibit they show a number of uniforms and equipments worn by the former captain-general of Cuba, General Blanco, and his officers during the Spanish-American war. The booth is in charge of Mr. Harry Kirkland, their New York agent, office 129 Greenwich St.

PRINDLE PUMP COMPANY, 120 Liberty St., New York City, have a fine exhibition of their centrifugal pumps operated automatically in connection with Messrs. Zindars & Hunt's automatic tank switch. The pump is directly connected to an electric motor.

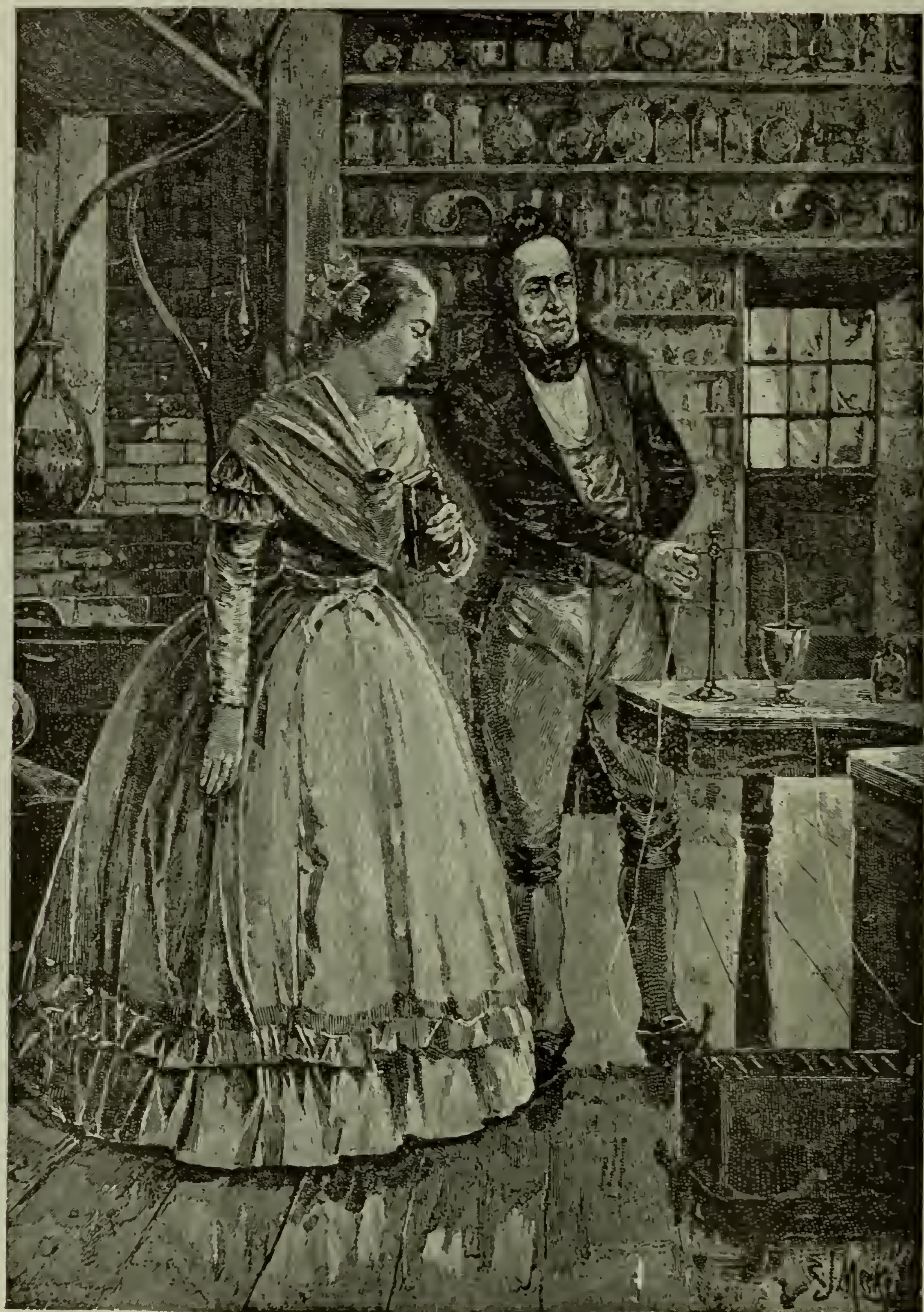
MR. TIMOTHY HOWARD, of the post and telegraph department, of Melbourne, Australia, was one of the interested visitors at the Show last week.

THE GREAT EXPERIMENT OF MICHAEL FARADAY.

*Franklin Leonard Pope.

On the morning of December 25th, 1821, the young wife of an assistant in the laboratory of the Royal Institution of London, was called by her husband to share his delight at the success of an interesting experiment, the possibility of accomplishing which had occupied his thoughts for many weeks. What the young woman saw upon entering the laboratory was this: upon a table stood a small vessel filled nearly to the brim with mercury; a copper wire was supported in a vertical position so as to dip into the mercury, while a little bar magnet floated in the liquid metal as a spar buoy floats in a tide way, having been anchored by a bit of thread to the bottom of the vessel. The mass of mercury having been connected by a wire to one pole of a voltaic battery the experimentalist had found that whenever the electric circuit was completed by touching the other battery conductor to the vertical wire the floating bar would revolve around the latter as a centre. In this simple manner a continuous mechanical motion was for the first time produced by the action of an electrical current.

The world is even now but just awakening to a conception of the magnificent possibilities of the humble gift which was slipped into its stocking on that Christmas morning by the since world famous man who not long before had jocosely described himself as "Michael Faraday, late book binder's apprentice, now turned philosopher."



Faraday's Discovery on Christmas Morning of Electro-Magnetic Induction.

Many brilliant discoveries almost simultaneously made shed upon the beginning of the nineteenth century the luminous light of original thought. Faraday as we have seen was successful in producing continuous mechanical action. Barlow, of Woolwich, elaborating Faraday's discovery, made in 1826, his electric spur wheel, a most in-

*From "Electricity in Daily Life." ("Scribner's")

genious philosophical toy and in point of fact the first organized electric motor. In 1826 Sturgeon devised the electro magnet. He bent a soft iron rod into horse shoe form, coated it with varnish and wrapped it with a single helix of bare copper bell wire. A current passed through the wire, rendered the rod magnetic and caused it to sustain by attraction a soft iron armature of nine pounds weight.

In this country Prof. Dana, of Yale, in his lectures on natural philosophy, exhibited Sturgeon's electro magnet. Among his listeners was Morse in whose mind was thus early planted the germ which ultimately developed into the electric telegraph. Prof. Joseph Henry, then a teacher in the Albany Academy, starting with the feeble electro magnet of Sturgeon, reconstructed and improved it and then by a series of brilliant original discoveries and experimental researches developed it into an instrumentality of enormous mechanical power, capable of exhibiting a sustaining force of two thousand three hundred pounds, a power which nevertheless vanished in the twinkling of an eye upon the breaking of the electric current.

The basic discovery of Faraday, the principle of electro magnetic induction, is a greater achievement as far as the benefits to mankind are concerned than the discovery of a continent. The good that has sprung from the universal use of electric power is enormous. Quick transportation, brilliantly lighted streets, and the possibilities in the near future of electric heating appliances in our homes means a complete revolution which is entirely due to the crystallization of the simple principle discovered by Faraday.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING MAY 9TH, 1899, $83,891.00.

New York, N. Y., May 9th, 1899.—The following exports of Electrical Material are from the port of New York for the wek ending this date:

Argentine Republic:—113 packages electrical material, $3,256.

Antwerp:—42 packages electrical material, $1,592.

British East Indies:—18 cases electrical material $491.

British Guinea:—4 packages electrical material $300.

Brazil:—34 packages electrical material $1,351. 17 cases electrical machinery, $1,195.

Bordeaux:—9 cases electrical material $100.

British West Indies:—168 packages electrical material, $4,526.

Bremen:—5 cases electrical material $250.

British Possessions in Africa:—2 cases electrotypes $30. 112 packages electrical material, $2,626. 1 case electrical material $6.

Cuba:—43 packages electrical material $573. 18 cases electrodes $7,500. 2 cases electrical machinery $107.

Central America:—11 packages electrical material $80.

Chili:—29 packages electrical material $1,358.

Ecuador:—9 packages electrical material $347.

Florence:—4 cases electrical material $967.

Fiume:—3 cases electrical machinery $306.

Glasgow:—1 case electrical material $298.

Havre:—28 cases electric motors $4,940. 71 cases electrical machinery $2,679. 145 cases electrical material $11,434.

Hull:—13 cases electrical material $650.

Hamburg:—89 packages electrical material $9,198.

Helsinfors:—2 cases electrical material $15.

London:—94 packages electrical materil $1,751. 22 css electrical machinery $1,490.

Liverpool:—10 packages electrical material $520.

Lisbon:—7 cases electrical material $215.

Mexico:—4 cases electrical material $42.

Marseilles:—106 packages electrical material $17,213.

Newfoundland:—3 cases electrical material $69.

Peru:—15 packages electrical material $566.

Roane:—8 cases electrical material $431.

U. S. of Colombia:—142 packages electrical material $4,819.

Wigan:—1 case electro shells $300.

NEW INCORPORATIONS

Portland, Me.—Standard Incandescent Burner Co., incorporated by John E. Sawyer, Frederick H. Jacobs, and others. Capital stock, $500,000.

Peoria, Ill.—Peoria Lighting & Power Co., has been incorporated by Lewis W. May, Geodfrey G. Luther, and Fred. Luthey, gas and electric heating, lighting and power plants. Capital stock, $50,000.

Schenectady, N. Y.—Fort Wayne Electrical Works, incorporated by J. P. Fulton, E. E. Gilbert, S. D. Greene, and George C. Hollister; manufacturing and selling electrical apparatus. Capital stock,$500,000.

Pierre, S. D.—The Milner Electric Co., incorporated by George Milner, E. L. Squire, and W. L. Shunk. Capital stock, $5,000,000.

Pierre, S. D.—The Nebraska Heat, Light and Power Co., incorporated by S. R. Briggs, Eugene C. Robinson, and W. L. Shunk. Capital stock, $2,000,000.

East Orange, N. J.—General Gas, Electric and Power Co., incorporated by George B. Dresher, Omar Powell, and William E. Beattie; gas lighting, heating and power. Capital stock, $75,000.

Hazleton, Pa.—The Edison Illuminating Co., West End Electric Light Co., and the Edison Electric Light Co., have formed a combination and will hereafter constitute one company, to be conducted by one management. The capital stock of the combined companies is $93,000.

Trenton, N. J.—The Korn Incandescent Light Co., incorporated by Ernest F. Ayrault, Charles W. Dayton, and J. P. Murray. Capital stock $12,000.

Mt. Gilead, Ohio.—Mt. Gilead Electric Light, Heat & Power Co., incorporated by W. M. Carlisle, M. Burr Talmage, and others. Capital stock, $50,000.

Jersey City, N. J.—Merritt Electric Air Brake Co., incorporated by Walter W. Bostwick, Monroe P. Wilkins and others; manufacturing and dealing in electric air brakes. Capital stock $1,000,000.

New York, N. Y.—Cox Electric Rail Co., incorporated by H. Barringer Cox, David Jankower and others. Capital stock, $1,000,000.

Pittsburgh, Pa.—Monongahela Light & Power Co., incorporated by W. E. Walsh, Chas. F. Farren and others. Capital stock, $1,000.

New Philadelphia, Ohio.—Goshen Electric Co., incorporated by Augustus Boyer, Adam Lieser, Wm. H. Lieser, Augustus A. Lieser and Geo. W. Wilson. Capital stock $5,000.

Columbus, Ohio.—Guernsey Electric Co., incorporated by William C. Benbow, W. P. Devore and others. Capital stock $5,000.

Paterson, N. J.—Sipp Electric Machine Co., incorporated by Grant Sipp and others; manufactutre electric machinery. Capital $50,000.

San Francisco, Cal.—Independent Electric Light & Power Co., incorporated by Claus Spreckels, John D. Spreckels and others. Capital stock $10,000.000.

East Orange, N. J.—Electric Process Co., incorporated by Oscar L. Lefferts, Geo. W. Mark, and Frederick W. Garvin; business of an electric company in all its branches. Capital stock $100,000.

Brutus, N. Y.—Weedsport Electric Light Co. has been incorporated by John D. Edwards, Harrison L. Hoyt and Wm. G. Thorne. Capital stock $15,000.

Sag Harbor, N. Y.—Sag Harbor Electric Light and Power Co. has been incorporated by Robert K. Story, C. S. Southard and S. S. Watson. Capital stock $25,000.

New York, N. Y.—Columbia Electric Supply Co., incorporated by S. C. McPherson, Wm. H. White, Jr., Thos. B. McGlynn and Harry W. Barkley. Capital stock $500,000.

St. Louis, Mo.—Scott Manufacturing Co., incorporated by Garnard Strode, Ashley D. Scott, J. H. Townsend and Jas. Butler; mechanical and electrical devices. Capital stock $10,000.

New York, N. Y.—San Juan Light & Transit Co., incorporated by P. H. McMillan, F. K. Curtis and others; electricity in Porto Rico. Capital stock $500,000.

Jersey City, N. J.—Consumers' Electric Light. Heat & Power Co. of Hudson County, incorporated by Rupert Schefbauer, Robert Randolph, Elmer P. Morris; electric light, heat and power. Capital stock $100.000.

TELEPHONE CALLS.

Salem, Mass.—Salem Telephone Co., incorporated by Henry A. Hale, Joseph M. Parsons, and George W. Pitman. Capital stock, $100.000.

Gallipolis, Ohio.—Gallipolis Telephone Co., incorporated by A. L. Bigeloy, Thomas E. Bradbury, William B. Shober and others Capital stock, $30.000

Mt. Sterling, Ohio.—Mt. Sterling Telephone & Electric Co., incorporated by Clay Johnson, C. W. Loofborow, and others. Capital stock, $6,000.

Salisbury, N. C.—The Salisbury Telephone Co., recently incorporated, has been purchased and will operate an established plant.

Winton, N. C.—The Mutual Telephone Co., has been organized, with W. A. Lemly, President; H. G. Chatham, Vice-President; B. B. Owens, Secretary-Treasurer, and J. F. Miller, General Manager.

Beaver Springs, Pa.—Spring Telephone Co., incorporated by J. D. Haines, H. Romig, Clymer Romig and others. Capital stock, $2,000.

Pulaski City, Va.—Wythe Telephone Co., incorporated by D. D. Hull Jr., B. F. Garnett, B. Laughon, and George M. Holstein. Capital stock, $5,000.

Palmyra, Va., Fluvanna Telephone & Telegraph Co., incorporated by C. E. Jones, T. E. Cowherd and others. Capital stock, $5.000.

Gainesville, Ga.—Col. H. P. Farrow will construct a telephone line from Gainesville to Dahlonega.

McComb City, Miss.—The Pike County Telephone C., incorporated by J. W. Johnson, W. M. White and others. Capital stock, $25.000.

Ellicott City, Md.—The Citizens Telephone Co., of Howard County, incorporated by Louis T. Clark, Frederick H. Bailliere and others. Capital stock, $15.000.

Lowell, W. Va.—Lowell & Greenbriar Valley Telephone Co., incorporated by A. C. Lowe, C. M. Perry, Jr., and others. Capital stock, $10,000.

Smithville, Tex.—The Smithville & Red Rock Telephone Co., incorporated by W. L. Moore, and others; to construct and maintain a telephone line betwen Smithville and Red Rock. Capital stock, $1,000.

STREET RAILWAY NEWS.

Silver Springs, N. Y.—Perry, Castile, Silver Springs and Pike Railway Co., incorporated by John H. and Joseph M. Duncan, Greenleaf S. Van Gorder, Albert O. Skiff and others; to operate a railway by electricity in Wyoming County. Capital stock, $200,000.

Port Huron, Mich.—The Port Huron, St. Clair and Marine City Electric Railway, incorporated, with a capital stock of $300,000.

Hannibal, Mo.—Hannibal Traction Co., has been incorporated by Charles D. Haines, Elmer T. Haines, Andrew G. Haines, Hiram McGonegal and others: electric railway. Capital stock, $100.000.

BUSINESS CHANGES.

Forest City, Ark.—The St. Francis Electric Light Co., has increased ith capital stock from $8.000 to $12.000.

POSSIBLE INSTALLATIONS.

Syacuse, N. Y.—Mayor McGuire may be addressed concerning construction of electric lightng plant.

Bad Axe, Mich.—A municipal electric lighting plant will be constructed.

Durham, N. C.—The Durham Electric Light Co., has been awarded contract for new machinery.

Barnwell, S. C.—A. Brill, of Aiken, S. C., is investigating with a view of establishing a telephone system and electric light plant at Barnwell.

Spartansburg, S. C.—F. T. McEuwen, representing T. L. Parks and B. F. Jennings, of New York, has received franchise for establishing an electric lighting, gas, heating and railway plant.

Joneston, Tenn.—The Mayor may be addressed c n cerning establishment of an electric lighting plant.

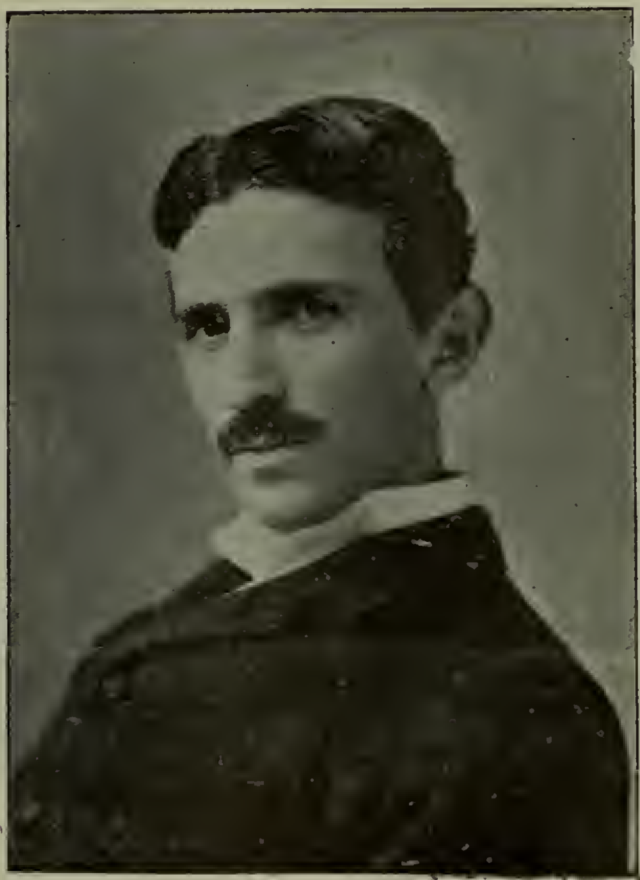
JOTTINGS.

The Montauk Multiphase Cable Company have arranged for an exhibit of their automatic thermostatic Fire Detective Cables at the Paris Exposition next year. The Company will make a very complete exhibit of their Fire Detective Wires in connection with all interior electrical adaptations, and it will undoubtedly be one of the electrical features of that Fair. The Convention of Municipal Electricians to be held in September of this year at Wilmington, Del., promises to eclipse any previous convention in numbers and exhibits. The progress of municipal fire protection from its beginning down to the present will be illustrated by apparatus in vogue during the various stages of invention. The Montauk Multiphase Cable Company will have a complete display of their product in connection with all interior wiring.

The Electrical Age.

VOL. XXIII—NO. 21 NEW YORK, MAY 27, 1899 WHOLE NO. 628

AMONG THE SOCIETIES.



NICOLA TESLA.

TESLA BEFORE THE CHICAGO COMMERCIAL CLUB.

In his speech before the Chicago-Commercial Club Mr. Tesla spoke about some of his recent experiments as follows, which we quote from our contemporary, the "Western Electrician":

"There is no one who does not speculate about the questions of his existence, asking whence he comes, whither he is going and what in reality he is. Soul and matter and their relations have eternal interest for human beings. On the other side, there is always the desire to comprehend the marvelous manifestations of nature in all its phases. Let us talk of all of these."

He illustrated his meaning by an experiment with two disks, which he said were similarly constructed.

"One of these has life in it," he said, "and the other has not." Picking them up, he added: "Which is the active one I cannot tell, but we shall soon see." Then, while his assistant turned on a current, he tested each and determined which one was dead and which one was alive.

Turning to another point, Tesla said: "It is necessary for us to assume a universal medium for the transmission of force. This results from the necessity of explaining the action of bodies at a distance. Energy is transmitted from the sun to the earth through some very attenuated medium. To show how much medium may be used under certain conditions I may refer to a feat I once accomplished of converting a column of gas into a solid body by the application of electricity in a certain manner. The gas became rigid and vibrated like a steel wire. Scientific men have not noticed the importance of this as yet. Again, I have produced a solid body in the

air on the end of a wire. I made a flame which consumed nothing and showed signs of solidification, for it offered resistance to the passage of bodies through it.

"The forces of the air may be utilized in a manner now that we have not learned to even contemplate. Nitric acid may be made from the components of the atmosphere.

"This nitric acid may be made to fill our reservoirs and then utilized to produce the energy we need and to transmit energy to almost unlimited distances."

His greatest invention, he said, was in utilizing the forces of the air.

"The air, which is an insulator," he said, "becomes a conductor by means of the millions of volts I am able to produce. It means the using of the air for all purposes and uses of men. Not only for the transmission of messages without wires, but for the transmission of power in any amount to any distance across the earth's surface."

Turning again to the distinction between living and dead objects, he said the two were not antithetic, but the distinction was one in consciousness. He criticized the superficiality of the ordinary idea of life, saying that if our senses were keener we would entirely lose the feeling of individuality. He said that there were experiments which could prove scientifically the question of the continuation of individual existence, but that these experiments were impossible to perform. They would consist, he said, in demonstrating that any atom in the body behaved differently toward atoms in the same body than toward atoms on the outside. He next described the stages in the appearance of life on the globe, saying that all life was originally generated in the water. Ranging all the way from the lowest forms of animal life to the most complex, he pointed out the impossibility of showing the axact point at distincetion between the phenomena of cause and effect and phenomena which mystify us. He gave his hearers something to see, flashing light in vacuum tubes without the aid of wires. Then he took a long tube in his hand and waved it like a flaming sword in the air before the machinery.

Describing many of the phenomena of his life and experience, he told how he had come to the conclusion that he was nothing else but an automaton in every act and sense. He explained how memory could be regarded as automatic, and told his hearers that some time he would write a philosophical treatise based on the facts he had observed.

"If I am an automaton," he said, "why should I not construct an automaton like unto me? What are the elements necessary? I am a heat-generating being, with powers of locomotion, with machinery to direct my movements, with a sensitive mechanism to provide data, and with a governing mind. My automaton must have all these qualities."

"SAFETY" FOR THE PHILIPPINES.

The big one hundred and fifty mile "Safety" cable was shipped to the Philippine Islands on board the Government cable steamer "Hooker" during the early part of May. This cable, which is partly of the one conductor and partly of the three conductor type, will be used by the United States Government in the big Philippine Islands cable for land and sea use. The illustration shows a view of the steamer "Hooker" while the cable was being loaded on board. The Safety Insulated Wire & Cable Company have worked day and night on this cable for several months and great credit is due to Mr. Leonard F. Requa for the celerity with which the order was filled. The cable will connect the six principal islands of the group and will be laid under the direction of Lieut. Col. J. E. Maxfield, an experienced signal service officer. Including the above the Safety Company have recently made for the government 680 miles of submarine cable for national defense for use in Cuba and the Philippines. The extremely rigid Government specifications have been met in every respect, fulfilling every requirement as called for.

"Safety" Being Loaded on Board U. S. Cable Steamer "Hooker."

A TRANS-CONTINENTAL TROLLEY LINE.

A dispatch to the New York "Journal" states as follows:

Stephen D. Carter, of Des Moines, proposes to build an electric railway from New York to San Francisco, which he says can be done for $300,000,000. Here is his description of it:

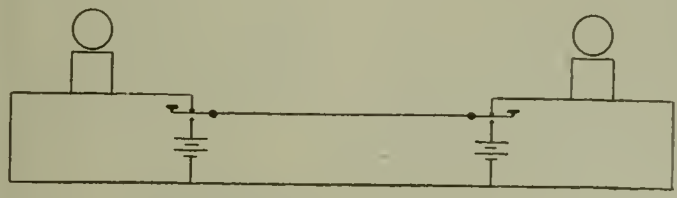
"The structure is to be similar in general construction to an elevated transit line, except that it is to be a double deck affair and to have four tracks on each deck. The outside tracks on the upper deck will be for through passengers, which will make not over ten or fifteen stops from coast to coast, making the trip from New York to San Francisco in twenty-two hours."

His idea is to tunnel through the backbone of the Rocky Mountains instead of taking a roundabout route over them.

TECHNICAL NOTES.

CONTROLLING BELLS.

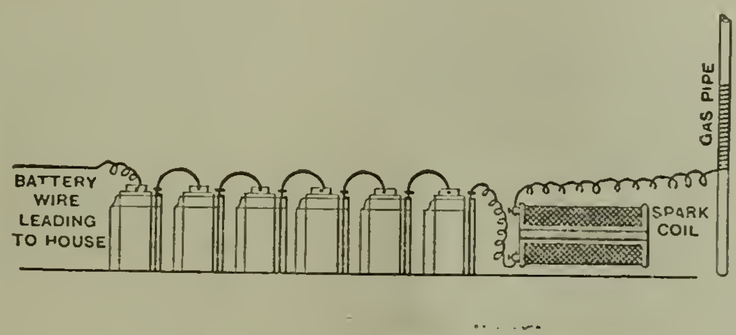
In this diagram the bell on the right hand is controlled by the button on the left; the button on the right hand controlling the bell on the left. By depressing the key or push only one set of batteries is thrown into operation and they operate the bell most distant from them as shown.



System of Controlling Bells.

ELECTRIC GAS LIGHTING.

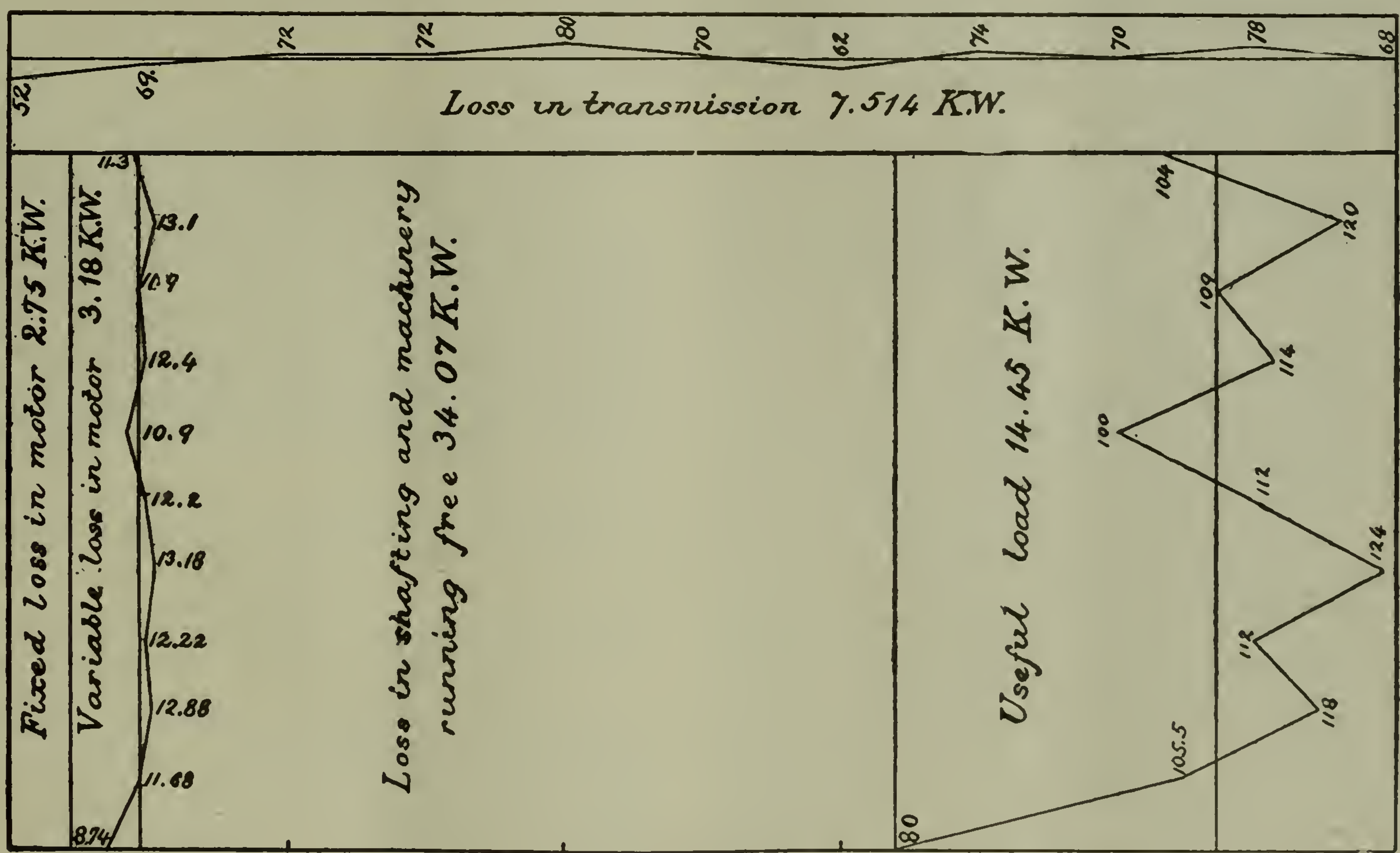
In this sketch the connections between the spark coil and gas pipe and from the spark coil to the batteries indicate a grounded system. Only one wire is used to connect one gas tip with the other. Chandelier after chandelier can be lighted by this apparatus; each chandelier being in multiple with its neighbor but its individual tips connected in series. In making the ground connection from the spark coil to the gas pipe it is an excellent plan to file the gas pipe to brightness, carefully wind the wire, stripped of its insulation, around it and solder. Gas lighting systems often fail because the ground connection is not properly made.



Electric Gas Lighting.

MOTORS IN MACHINE SHOPS.

A great deal of unnecessary discussion arises at times as to the advantage of using motors in lieu of gas engines and steam power. It is not within the province of this paper to consider anything but electrical machinery. As far as a motor is concerned the following diagram will probably illustrate clearly the power received as compared with the power sent into at motor. The fixed loss is 2.75 kilo watts; the variable loss 3.18 kilo watts; the loss in shafting in this particular case, with machinery running



Motor Lossss by Shafting.

free, 34 wilo watts. The useful load amounts to 14.5 kilo watts. The loss in transmission is 7.574 kilo watts. The curves above and below show variable loads when work is not and is being done.

MISCELLANEOUS.

STRAY CURRENTS.

DEPOSIT OF MAGNETIC IRON.

Advices from Cape Breton announce the discovery of an immense deposit of magnetic iron on George's River mountain, a few miles from North Sydney.—Exchange.

CARBON ELECTRODES.

The carbon electrodes of an electric furnace are now made as big as 1 ft. square, carrying about 30 amperes per square inch. They were formerly made cylindrical, but that shape is now abandoned.—Exchange.

RAISING SUNKEN CARGOES.

It is reported that a new plan for raising sunken cargoes of metal, such as steel rails, will shortly be tested in the Delaware bay. A suitable crane boat will be equipped with dynamos and large electro-magnets incased in watertight coverings, capable of lifting 4,000 pounds each. The magnets will be lowered to the sunken cargo from cranes and connected to the dynamos by flexible cables. They are expected to lift the submerged metal with ease. It is also claimed by the inventor that by letting magnets drag over the beds of channels valuable cargoes which have lain submerged for years can be located—Exchange.

A USEFUL ALLOY.

Experiments in the Sibley laboratory at Cornell University have shown that an alloy of two-thirds aluminum and one-third zinc possesses some remarkable qualities. It is white and takes a fine finish, and is equal in strength to good cast iron, but superior to it in elasticity. On the other hand, it melts at 800 or 900 degrees Fahrenheit, and can be liquified in a ladle over an open fire. In the liquid form it fills a mold, running into all the small parts much better than brass, but is more brittle than brass. With it small castings can be made without the use of a foundry furnace.—Exchange.

THE GERMAN ATLANTIC CABLE.

President McKinley has now given permission for the landing of a cable to be laid direct from Germany to the United States. The occasion of the permission being given has been celebrated by telegrams between the German Emperor and the President, in which great hopes are expressed as to the effect of the new cable in binding the two nations together. In consequence of this move the German Atlantic Telegraph Company at Cologne will at once proceed with the erection of a factory at Nordenhamm, where the cable is to be manufactured.—Exchange

FIGURES REGARDING THE NERNST LAMP.

The Elektrotechnischer Anzeiger states that the incandescing rod in a 400-volt Nernst lamp should be about one and five-eighths inches long. The cost of lamps is about $5 each, for sizes to replace ordinary arc lamps. The efficiency is from 1.5 to 1.6 watts per candle, lying between those of arc and incandescent lamps. The color of the light is whiter than that of the glow lamp, approaching that of the arc. The life of the rods is about 500 hours, and their renewal is said not to be costly, but the price of renewal is not given. As to fire risk, the Nernst rod is as hot as an arc carbon, its temperature being about 3,000 degrees centrigrade. Lamps as small as twenty candle-power can be made for 400 volt circuits.

ELECTRIC ROAD IN BRESLAU.

Consul Erdman writes from Breslau:

I wish to inform our manufacturers of and dealers in street car rails, electric motors, wire and electric supplies that the street company of this city, which has been using horse power, has been granted the privilege by the city authorities to employ electric motive power at the expiration of its present charter, which will be in 1902.

AMERICAN ELECTRICAL MACHINERY IN BRAZIL.

The following extract is from a report made by Mr. Worthington, Commissioner of the Board of Trade to South America, on trade conditions in Brazil. This report was sent to the Department of State by Mr. Henry White, secretary to the Embassy at London:

"In electric machinery, the American has by far the largest sale. It is worth noting in this connection that there is an American electrical expert here, with electrical experts under him, who is well backed by a big American company. He has a large store where he displays his wares, and is, I am assured, the only man in the place who is prepared to estimate at once for an electrical installation anywhere in the country; others have to write to principals. It is not surprising that, quite apart from considerations of suitability and cheapness of machinery, he does the most business."

If American manufacturers in other lines desirous of introducing their goods in South American, as well as other foreign countries, would adopt the course pursued by the manufacturers of electrical apparatus, they would find their task very much easier and their efforts more successful than hitherto. It is the "on the spot" policy which has made American electrical machinery as successful as it is.

AMERICAN ELECTRICAL MACHINERY LEADING IN JAPAN.

Under date of February 6, 1899, Consul Lyon, of Osaka, writes as follows: "It may be said that our country has the Japanese market in electrical machinery. Electrical engines are also imported from the United States, and they are giving general satisfaction. Telegraphic machinery was imported into Japan during 1897 as follows:

United States	$2,301
Great Britain	1,102
Germany	691

"But little came from any other country. The Japanese Government owns both the telegraph and telephone service. It is said that considerable delay has frequently occurred in the execution of orders from Japan for electrical machinery in Europe, and that, in consequence, the American market has been given the preference, with the result that the superiority of such machinery has been fully established here. The more direct communication between the United States and Japan, together with the lowering of overland freights, should stimulate manufacturers of machinery to increased effort for this market.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

ATTENDANCE AT THE NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION.

The twenty-second annual convention of the National Electric Light Association, which opened at Madison Square Garden Tuesday morning, May 23d, will go on record as having had the greatest attendance of any convention heretofore held by the association. One hundred and fifty members were present when President Young rapped the meeting to order. The transactions of the meeting have been increasing in importance year by year until now the conventions are looked forward to with the liveliest interest not only by the members, but by electricians at large, hence this extraordinary attendance.

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NEW YORK, MAY 27, 1899.

CONTENTS.

THE USE OF ULTRA VIOLET LIGHT.

We hear again in the columns of different scientific journals of discoveries made in ultra violet light and reference to its application. The "Scientific American," for instance, discusses these rays and claims that Fessenden was the inventor of a telegraph system employing them. The medical field is now taking up the subject and Dr. J. Mount Bleyer believes that certain cases of pulmonary troubles are readily cured by the use of violet rays.

The subject is not a new one as far as the medical fraternity are concerned, as many suggestions have been made by members of that fraternity on the possible use of X-rays, violet rays and others for the prevention and cure of microbic diseases. Our most distinguished American inventor is of the opinion that organic tissue when permeated with such rays is cleared of all micro-organisms. We also know by experience that bright sunlight means death to microbes. Therefore, there seems to be nothing healthier than a bedroom cleansed by sunlight at morn and eventide. As far as the action of other waves in general upon microbes are concerned, we may regard it as more than a supposition to believe that they do certainly annihilate minute forms of life, possibly by creating a chemical action in such organisms. The entire field seems to be more one of speculation than of fact, and many a year may pass before physicians will be positive regarding the influence of ultra violet rays upon the body in general or the lungs in particular.

The trend of investigation is so directed that there is undoubtedly some foundation for the curious results that occasionally come to light. When reputable physicians are emphatic in their statements regarding the curative properties of violet rays or other rays, we are bound to listen on account of proofs which they bring forward any symptoms which they detect. It would be a pleasure for us to know that phthisis or tuberculosis can be cured by such rays, although the subject from a physiological standpoint is absolutely beyond our ken.

GAS ENGINES FOR ELECTRIC LIGHTING.

The combustion of gas within the cylinder of a gas engine has been a subject for careful study for more than twenty-five years. The introduction of the automobile and the ever crying demand by dynamo manufacturers for an automatic and well regulating gas engine has so stimulated the efforts of gas engine manufacturers that seven hundred horse-power engines have been constructed by them and operated successfully. An American concern is making great strides in this direction and according to recent reports have been so far successful in the construction and operation of a gigantic gas engine that they believe that with the reduced price of gas it will not pay to invest in boilers or to deal with fireman and the appartus they are supposed to run. The heaviest consumption of gas is about twenty-eight cubic feet per horse power hour. With gas at fifty cents a thousand one horse power would cost a little more than a cent. In large electric light plants where big gas engines are used the gas consumption would reduce down to about one-half of the above or fourteen cubic feet per horse power hour, costing about half a cent. A large station sending out power for ten thousand incandescent lights could do so with economy and a much cheaper establishment than if operated by steam. At twelve lamps per horse power about eight hundred horse power would be required costing about four dollars an hour outside of labor, taxes, etc. In addition to this no boilers would be used, which would mean a saving of floor space and no pumping machinery, condensers, etc., would be required. Allowing four pounds of coal per horse power hour for eight hundred horse power, about thirty-two hundred pounds of coal would be required, roughly speaking, about a ton and a half, which at the minimum price of three dollars a ton would cost four dollars and fifty cents. It seems from these figures that gas would cost about fifty cents an hour more than coal. It is unnecessary for us to state what a great difference there would be in labor and first outlay. Within the next five years some remarkable changes may occur in power and electric light stations. The steam engine may pass away and the gas engine occupy first place in the minds of capitalists.

THE PHYSIOLOGICAL EFFECTS OF ALTERNATING CURRENTS OF HIGH FREQUENCY.

At a meeting of the Franklin Institute long since past Prof. Edward J. Houston speaks of the physiological effects of alternating curents of high frequency. He divides electric discharges into three varieties. First, galvanic currents; second, alternating current, commonly called faradic; and third, electro statis discharges which may be called Franklinic currents. It seems as though Franklinic and faradic currents produce about the same effect upon the muscles. Another fact is equally true that as the rapidity of alternation increases, the severity of the physiological effects decreases until when enormously high frequencies are reached, the discharges become harmless. These facts have been demonstrated by Dr. Tatum for comparatively high frequencies and by Nikola Tesla for enormously high frequencies. To quote from Tesla, we conclude with the following: "I have found that by using the ordinary low frequencies the physiological effects of the current required to maintain at a certain degree of brightness a tube four feet long provided at the ends with outside and inside condenser coatings is so powerful that I think it might produce serious injuries to those not accustomed to such shocks; whereas with 20,000 alternations per second the tube may be maintained at the same degree of brightness with any effect being felt."

ELECTRICAL ENGINEERING.

*ENGINEERING IN RUSSIA AND THE USE OF NAPTHA FOR FUEL IN RUSSIA.

By Alexis Gatzook and Stephen Goulishambaroff.

The number of stationary steam engines used in Russia including the Causasus and Siberia but without Finland, according to the official data of 1894 amounted to 12,900 with 640,000 indicated horse power; the number of boilers for them was 18,200, having a total heating surface of 10,750,000 square feet. The total number of all boilers including those of portable engines and river steamboats, but without locomotive engines (about 8,000) in 1896 was 38,800 with heating surface of 17,090,000 square feet. The use of steam on such small scale in our vast country is caused by the low development of our industries as the total number of workmen in factories and mills forms only one per cent. of the total population; furthermore, owing to the low wages paid to workmen, it is rather advantageous to have such work done by hand, which in other countries, where workmen are paid much dearer, is exclusively done by machinery.

Steam engines are concentrated in several manufacturing regions. The Moscow region (governments of Moscow and Vladimir) is now the most important for the spinning and weaving industries; in the St. Petersburg region the above industries are also much developed, as well as the construction of machinery and the metallurgical industry; in the south, in the Skaterinoslay governments and the Don region the mining and metallurgical industry is greatly developing; in western Poland the weaving and spinning industries, as well as the mining industry, are much developed; in the Urals the population is almost exclusively occupied with mining and metallurgy. The naptha industry is concentrated near Backu, in the Caucasus. Large steam flour mills are situated on the river Volga and in southern Russia, near the Black Sea; but sugar works principally in south and western Russia.

The steam engines used in Russia are of very different types, although people well acquainted with the steam engines of other countries will not find anything original in them, therefore I give no drawings of these machines.

Russia never showed any particular preference for cylinder engines with automatic cut-off, therefore for the large machines the tandem and compound types have been always preferred; triple expansion machines made their appearance in Russian factories some eight years ago, but at present nearly all the new machines of large dimensions are made triple expansion.

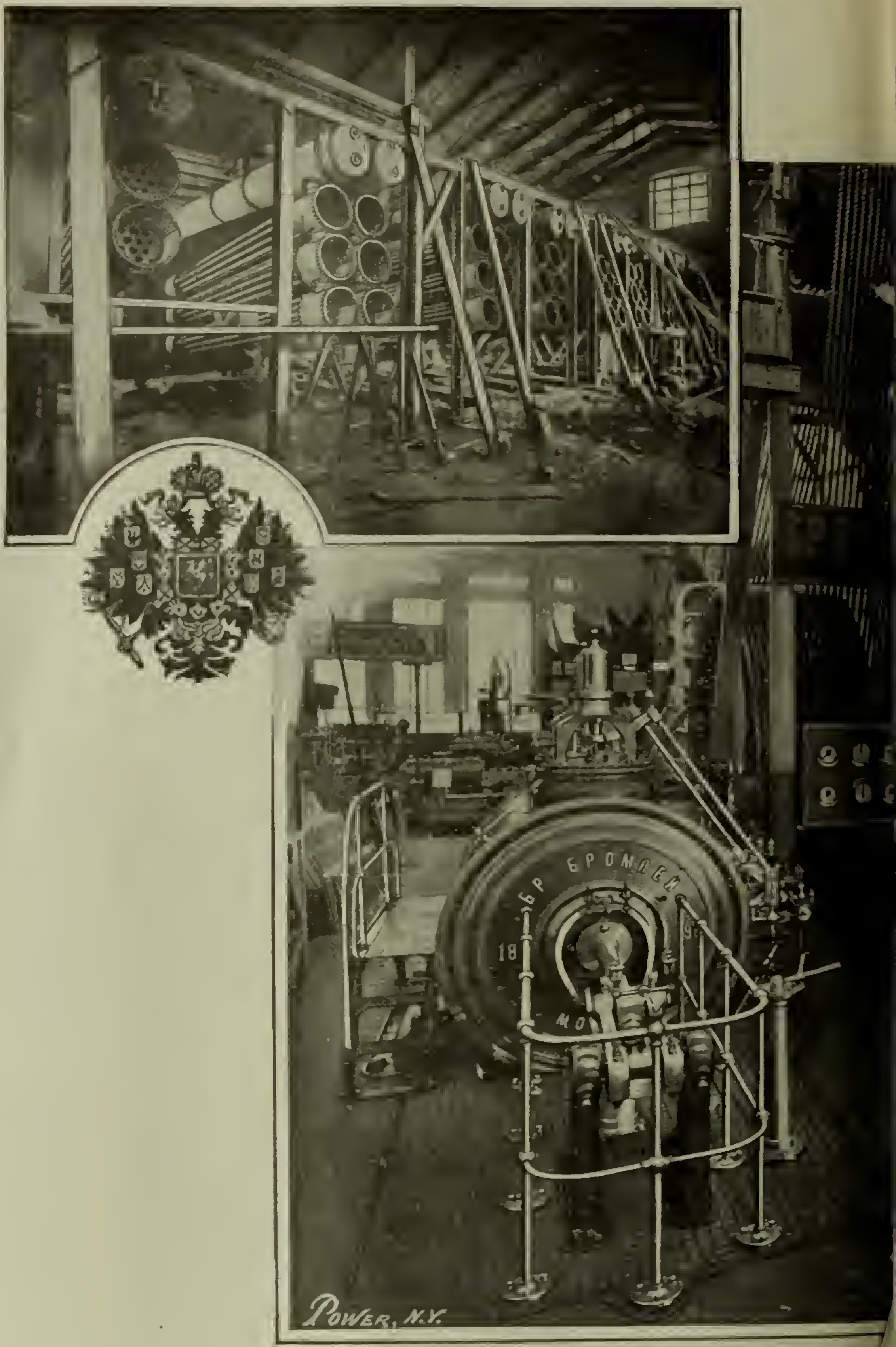
Steam blowing engines for blast furnaces were formerly always beam engines; later on Cockerill's type of vertical steam blowing engine came into use; at present they are made horizontal and duplex with cam distribution and double beat valves. Bessemer's steam blowing engines were always horizontal and duplex, now they are made with double beat valves.

American engines are very seldom used, and only those of the Westinghouse make The American types of steam pumps can be often seen in Russia, Blake's, Deane's and Worthington's pumps are very well known here and are even imitated. Russia herself produces a great number of steam pumps.

The most prominent works in Russia for producing steam engines are: Bromley, Dobrar and Nabholz, and Hopper in Moscow; Lessner in St. Petersburg, Felga in Riga, Greter and Krivanek in Kiev. All these works are adapted for general engineering work, the building of steam engines being only one of their specialties.

The predominant type of boilers, if no high pressure is required are the English boilers with internal flues. During recent years, owing to the general use of triple expansion engines, the water tube boilers have become popular. Among the latter are generally preferred those made by the Babcock & Wilcox Co., and the numerous Russian imitations and variations of same.

The most original Russian tubular boilers, and greatly used too, are those of the system of Shukhow; the inclined tubes are placed in bundles consisting of 19 pieces each:



Engineering

the ends of these tubes are expanded at the plain bottoms of short cylindric drums, the opposite ends of which are closed up by one general cover for all the 19 tubes; separate bundles of tubes with their end drums are placed by two and three, one above the other, the drums in one

vertical row are connected one with another and with the upper water and steam drum and the mud drum behind, below so that the water can circulate and the whole system forms one section of the boiler. A battery of this

Russia

type of boiler is shown under construction in the upper panel of the engraving on page 13.

As regards the system of furnaces for boilers the most original are those in which petroleum products are used as fuel. The heating with naptha residues is in great vogue in Russia; as Russian naptha always contains a great quantity of heavy hydro-carbons and is distilled principally for procuring kerosene, there remain many products which are adapted for heating purposes. Boilers are heated in preference by naptha atomized by steam. There are a number of different pulverizing apparatuses. It rather seems that too great attention is paid by Russian inventors to the construction of such apparatus, as, notwithstanding the difference in construction, they nearly all give equally successful results.

The Russian exposition of 1896 at Nijni-Novgorod proved that boiler making in Russia has acquired a considerable development, and the best boiler works can execute in an irreproachable manner the most complicated boiler parts, as, for example, sinuous harders made of wrought steel for Babcock & Wilcox boilers. The most prominent boiler works in Russia are: The Metallic Works in St. Petersburg; Fitzner & Gemper in Seltzy, Barg in Moscow, Borman & Shevede in Warsaw.

With regard to the use of fuel in Russian factories it must be said that according to the official data of 1893 the quantity of wood used formed 46 per cent., coal, 40 per cent.; naptha, 10 per cent, and peat 4 per cent. (equivalent quantities.)

NAPTHA FUEL FOR STEAM BOILERS IN RUSSIA.

Naptha for fuel was first introduced into Russia in the year 1870, when the French Apparatus of S. Deauville and the English pulverizator of Eidon were first adapted to the boilers of the steamers running on the Caspian Sea. For stationary boilers naptha began to be used latter. Until then the use of naptha was not so universally known, and at the place of its production there were no steam boilers. At present naptha is in very great use in the whole of European Russia, and the extraction and working of it is exclusively done by steam, for which purpose in Backu, the principal town for the production of naptha, there are more than one thousand boilers, for the heating of which about 250,000 tons of liquid fuel are annually consumed. This liquid fuel is sold now at the place of its production at $2.50 per long ton.

During the last twenty-five years, when naptha has been in such great use in Russia, a large number of different apparatuses has been tried for the burning of this fuel, all of which can be expressed in the following four types:

1. In the apparatus of the first type the naptha is preliminarily changed into gas, and already as such is used for fuel.

2. The naptha is made to pass through fire proof materials, which serve instead of wicks and along which it ascends on lamp wicks.

3. The naptha is burned in its liquid state in burners, similar to lamp burners.

4. With the aid of steam or compressed air naptha is pulverized into the smallest drops or dust, and thus the liquid fuel is changed into steam or gas.

The principal aim of the Russian technical engineer at present is the regular construction of the accumulators of the furnaces, which concur to a more rapid burning of the fuel and to a more economical use of the heat. Many improvements have been made in that respect, owing to which naptha fuel is rapidly spreading in Russia, and it is often preferred to hard fuel, as it is easier to manage than wood or coal. Practice of Naptha heating in Russia has proved that one ton of naptha supplants 3.2 tons of turf, 2.67 tons of Moscow coal, 1.38 tons of cake or English coal, 1.45 tons of Donetz anthracite and 11.4 cubic yards of wood.

*Condensed from "Power."

St. Mary's, Ohio.—St. Mary's Telephone Co., incorporated by O. E. Dunan, Oliver Jay, D. W. Jay and others. Capital stock $20,000.

Atkinson, Ill.—Henry County Telephone Co., incorporated by W. D. Colby, W. H. Cosner and Isaac Pyle. Capital stock $2,500.

ELECTRO-THERAPEUTICS.

AN ELECTRICAL INSTRUMENT FOR THE FAMILY.

The phono-faradic apparatus as used by Dr. Henry C. Houghton, and manufactured by Waite & Bartlett Mfg. Co., B. & E. Hanfeld, agents, of 108 E. 23d Street, New York City. for treating deafness and affections of the ear by electrical massage is herewith illustrated. The beneficial effects are obtained in the following named: Ringing, hissing, humming and buzzing noises, torpid nerves, and tissues, adhesions and congestions, depressed drums, deafness from quinine, fevers, measles, chronic catarrh, nervous affections, paralysis etc., etc.

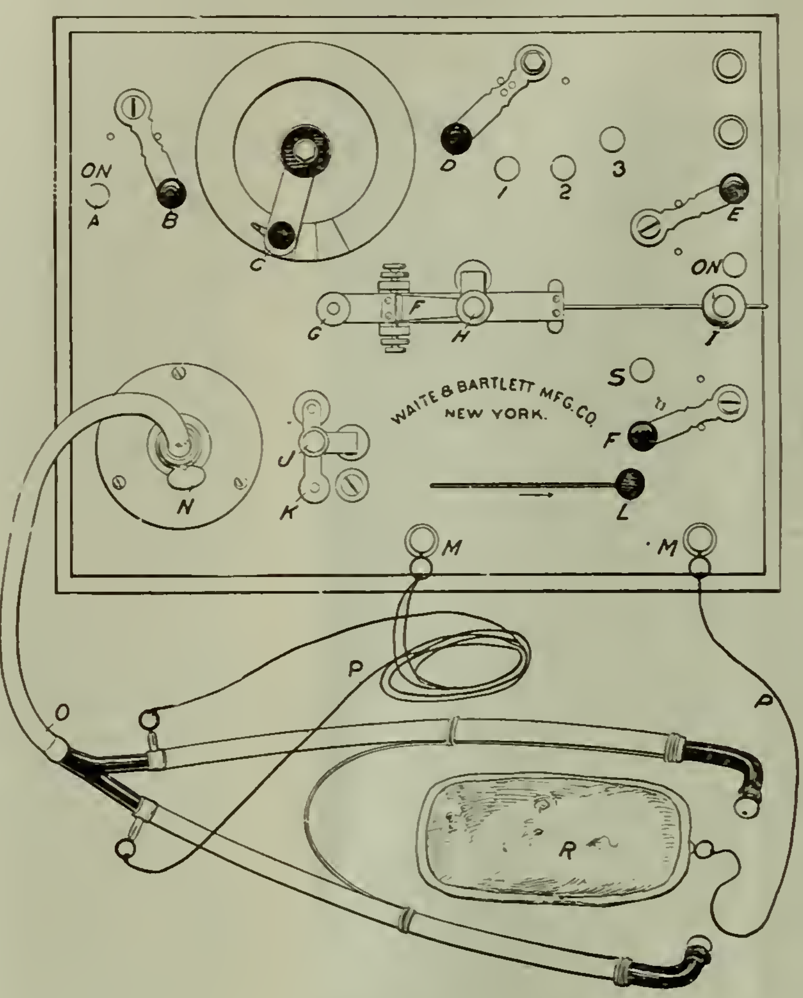


Fig. 2.

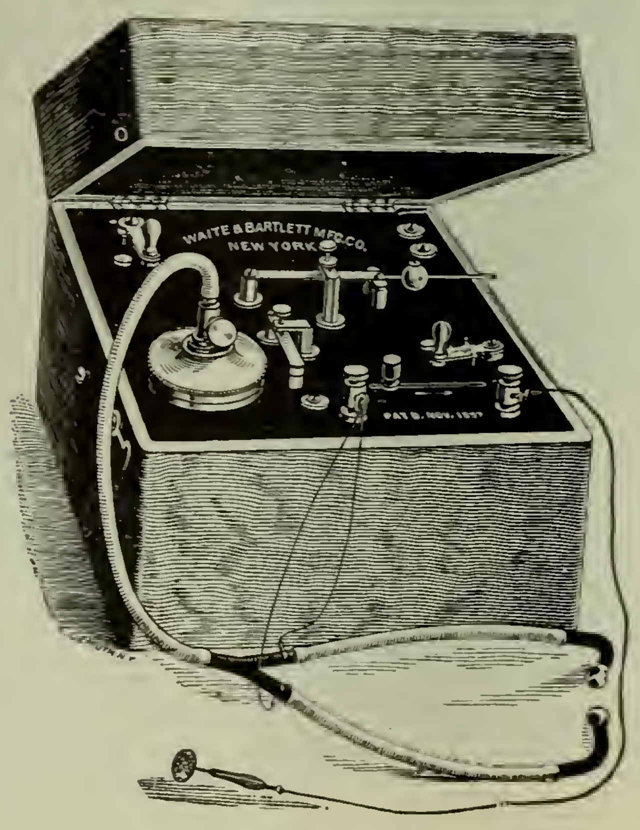


Fig. 1.

In this instrument two forces are generated, viz.: the electrical impulse and the mechanical massage—both actuated from the same cell. They can be used separately or combined, as the case demands. These essential forces have different therapeutic effects on the drums of the ear. For instance, the bombarding breaks down the adhesions on the small bones, while the tonic properties of the other strengthen weak nerves and tissues. This instrument, with its wide range of effects, its ease of manipulation and freedom of complications, commend it to those afflicted with diseases of the ear.

It has been found that certain diseases may be effectively treated and in many cases cured by subjecting the parts to massaging action, and especially in connection with an electric current, and the present invention has for its object to provide a simple, convenient and effective apparatus whereby certain portions of the human body may be simultaneously subjected to massaging action and an electric current, and to those ends my invention consits in an apparatus embodying the features of construction and arrangement substantially as hereinafter more particularly pointed out.

Referring to the accompanying drawings: Figure 1 is a plain view showing the apparatus; Figure 2 is a diagrammatic view of the electric and pneumatic conditions

In a suitable case are arranged the working apparatus for causing the current and impulses. Conveniently arranged in the case are the battery cells, one or more, preferably dry batteries, and these are connected to the binding posts B, which in tuin are respectively connected with a switch C, on one side, and a switch D on the other, so that when one or both of the switches are open, the battery is not excited. Within the case and mounted on the partition of platform A, are two inductoriums, E, F, and the primary circuit extends from the switch C, by the conductor 1, around the core of the inductorium E, and thence by the conductor 2, around the core of the inductorium F, to a point 3. From thence a conductor 4, branches to contact 5, having a key 6, connected to a conductor 7, leading to contact 8, of switch D. When the switch D is on the contact 8, by pressing the key 6, single impulses may be sent through the primary at any desired rate of speed.

TESLA'S ELECTRIC CIRCUIT CONTROLLER.

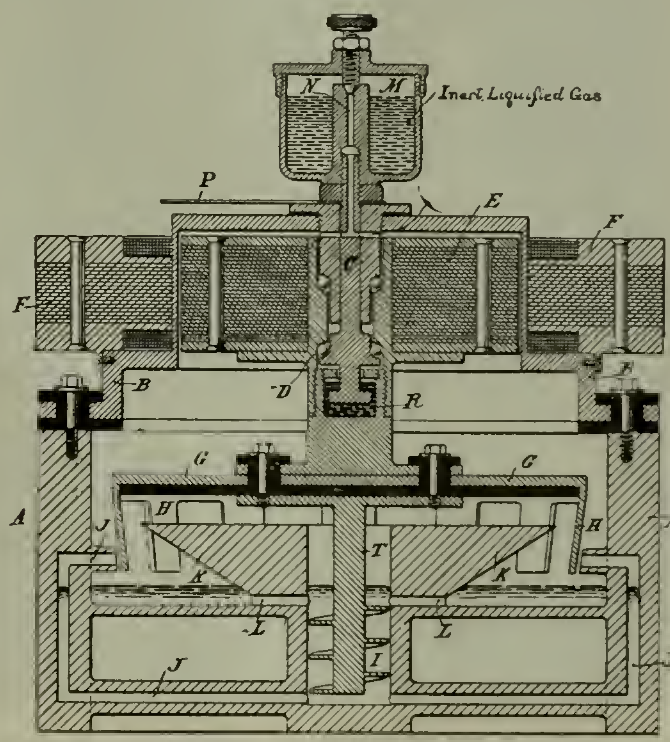
Nicola Tesla has recently patented a circuit controller, wherein he employs, in an inert and highly insulating gas, the conducting fluid mercury, for one terminal and for the other, a horizontal metallic disk with downwadly extending teeth which, when revolved are impinged upon by jets of the mercury, thus making and breaking the circuit.

In the following description of the apparatus reference is made to the accompanying drawing, which is a vertical section through the centre of the complete circuit-controller. A is a metallic receptacle with a cover B, secured with a gas-tight insulating joint. Within this receptacle is contained the entire circuit-controller mechanism. A spindle C is secured in the cover B and on this is mounted on anti-friction bearings a body to which rotary motion can be imparted. To impart rotation to this body there is secured to the rotary sleeve D a laminated magnetic core E and there is also placed around that portion of the cover B, which contains it, a core F, provided with coils and constituting the primary element of a motor capable of producing a rotary field of force which will produce a rapid rotation of the secondary element or core E. To the lower end of the sleeve D is secured a conductor G in the form of a disk with downwardly extending teeth H. To this disk G there is attached, but insulated therefrom, a shaft T, having a spiral blade and extending down into a cylindrical recess in the bottom of the receptacle. Several passages J lead from the bottom of this well to points near the path of the conducting teeth H, so that by the rotation of the screw, the mercury that is put into the recess will be forced up through the ducts J, from which it issues in jets against these sotating conducting teeth the mercury returning to the recess, facilitated to do so by the downwardly deflecting flanges K and the passages L.

M is a reservoir communicating with the interior of the main receptacle and containing a liquidfied gas, such as ammonia, which maintains a practically inert atmosphere under pressure.

The cup M has a hollow central stem N, which serves as an outlet for the gas and is controlled by a screw-valve in the top of the cup. This cup is attached to the end of the spindle C, through which is a passage O, leading into the interior of the receptacle A.

The receptacle A being insulated from the cover B and the parts attached thereto are connected to one part of the circuit to be controlled. The other circuit connection is made by a conductor P to any part of the cover, so that the circuit will be completed between the two in-



Electric Circuit Controller.

sulated parts of the receptacle through the jets of mercury whenever they impinge upon the said conductor.

To insure a good electrical contact between the sleeve D and the spindle C, the latter extends into the mercury cup R of the sleeve.

The advantages of this form of circuit-controller will now readily appear.

Because of its simplicity a very high rate of speed of rotation can be obtained, so that the make and break of the circuit becomes very rapid. Together with the use of mercury, this reduces the time of passage of the current through an arc to a minimum and diminishing thereby the losses incident to the closing and opening of the circuit.

The terminals must be an extremely short distance apart before the current leaps across the intervening space since the ammonia gas has a very strong resistance.

Since the medium is chemically inert, there is no destruction of the electrodes and no chemical action which might result in heat or in some other loss of energy.

The advantages derived from the application of pressure to the medium are as follows:—first, there is an instantaneous closing up or repair of that part of the medium that might be injured, thereby restoring the insulating

power; secondly, it diminishes the striking distance of the arc inversely by its pressure; and thirdly, the cross section of the arc is diminished inversely as the pressure. Since the waste of energy in an arc is proportional to its cross section an important gain is thus made.

THE KERITE CABLE FOR THE PHILIPPINE ISLANDS.

On board the U. S. Government cable steamer "Hooker," which left for the Philippines during the first week in May were thirty miles of Brixey's Kerite deep-sea submarine cable. This cable will form part of the Government cable which will connect the different islands of the Philippine group. The Government specifications for this cable called for an insulation resistance of not less than one thousand megohens per mile and a pressure test of five thousand volts. The test on board the "Hooker," made by the Government electrician, showed an insulation resistance of 3,900 megohens per mile. The cable is made up of 7 No. 21 B. & S. guage tinned copper wires and complete weighs about three tons to the mile. The illustration shows how the cable was shipped from the factory at Seymour, Ct., where it was manufactured

Kerite Cable for the Philippines.

OBITUARY.

MAURICE A. MULLER.

Maurice A. Müller, a well-known mechanical and electrical engineer, and chief of the draughting department of the Weston Electrical Instrument Company, of Newark, N. J., died Sunday morning, May 21st, at his home in Newark. Mr. Müller was born in Germany in 1841 and came to this country about fifteen years ago. He was an expert in mechanical and electrical engineering and was also instructor in mechanics at the Newark Technical School.

He was in charge of the erection of the works of the Weston Electrical Instrument Company at Waverly, N. J., which embody the idea Mr. Miller acquired during his visits to the largest manufacturing establishments of the United States.

PERSONAL.

R. J. Russell.

R. J. Russell, late chief engineer and master mechanic of the New Jersey Electric Railway Company,—better known as the Rutherford Road—power house at Secaucus, N. J., is seeking to locate himself with some good electric light, power or railway company. Mr. Russell was chief engineer at the World's Fair, Chicago, for the General Electric Company and holds the highest testimonials for construction and maintenance work. He can be communicated with at 1,310 Havemeyer Building, 26 Cortlandt St., care of Francis Granger.

EXHIBITIONS.

ELECTRICAL SHOW NOTES.

THE AMERICAN ELECTRIC HEATING CORPORATION, of Boston, Mass., show their various electric heating devices for domestic, industrial and scientific purposes. The exhibit is in charge of Mr. J. E. Sayles with assistants, one of whom, a Syrian lady, dispenses steaming hot coffee, heated on an electric heater, to visitors.

THE CLING-SURFACE MANUFACTURING CO., Buffalo, N. Y., show side by side dynamos whose

belts are respectively coated with and without "Cling Surface" with the advantage greatly in favor of those whose belts are coated with the compound. The contrast is remarkable and the exhibit is the centre of attraction for all engineers.

AMERICAN ELECTRIC VEHICLE CO., Chicago, Ill., show different styles of their automobiles. Mr. H. G. Osborn is at the exhibit.

H. E. PLASS ELECTRICAL CONSTRUCTION & SUPPLY CO., of 23 Barclay St., New York City have on exhibition a complete line of medical batteries and also their specialty, the electric light rose for button holes, one of the most interesting little novelties at the show.

THE H. B. CAMP COMPANY, of Aultman, Ohio, manufacturers of vitrified clay conduits, have a fine exhibition of their manufactures.

THE S. S. WHITE DENTAL M'F'G. CO., of Philadelphia, Pa., show a complete line of their various electro medical and dental specialties, including the famous Partz acid gravity battery. This is an exhibit which no member of the medical and dental profession fails to examine with the greatest interest.

GENERAL INCANDESCENT ARC LIGHT COMPANY, of Thirty-third Street and First Avenue, New York City make one of the finest displays at the exposition. Their exhibit contains their noted enclosed arc lamps in every conceivable position, "Paragon" fan motors keeping streamers flying at every point of the booth, cutouts, switches, panel and switchboards of all styles and the various other articles manufactured by them.

THOMAS A. OAKS, a well known manufacturer of Bloomfield, N. J., purchased one of the Wood automobiles at the Electric Show, May 18th.

J. K. Ullrich & Co., Thames Building, New York City, show a complete line of their well known "Independent" and "Vulcan" fountain pens, Mr. J. K. Ullrich being in charge of the exhibit.

J. JONES & SON, 64 Cortlandt Street, New York City, show a fine switchboard of their latest make, fitted up with meters, switches, colored lamps, etc. They make a lot of noise and fire by blowing their new Noark fuse every evening to show the advantages of this latest and best fuse on the market.

B. & E. HANFELD, 108 E. 23d Street, New York City, manufacturers of cataphoric, diagnostic and medical instruments of all kinds, are making a special display of their phono-faradic apparatus, for treating deafness and affections of the ear by electrical massage, at their exhibit at the Electric Show. Messrs. Hanfeld are in attendance at the exhibit and always willing to explain the advantages of their valuable apparatus.

DR. WAITE, of the Waite & Bartlett Mfg. Co., 108 E. 23d Street, New York City, has one of their famous Ranney-Winshurst-Holtz static machines on exhibition in the gallery of the Garden, creating a great furor among the attendants at the Show.

THE BURNET COMPANY, 115 Maiden Lane, New York City, show a complete line of their tip and tipless incandescent lamps, the exhibit being in charge of Albert C. Jahl.

JOHN A. ROEBLING'S SONS COMPANY, of Trenton, N. J., manufacturers of iron and steel wire rope, bare and insulated wire of all kinds, show a fine line of samples of their products. Mr. H. L. Shippy, the secretary and New York manager of the company, office 117 Liberty Street, has charge of the exhibit with a corps of able assistants.

THE UNIVERSAL ELECTRIC PULL SOCKET & SWITCH COMPANY, 35 South William St., New York City, makers of the Eschwei '99 enclosed arc lamp, have established themselves in a fine Turkish booth in the gallery of the Garden where they show several styles of their $2\frac{1}{2}$, 4 ampere and other lamps with and without shades. Mr. Stirn, the manager of the company, has been busy daily putting up his lamps in a number of booths. Mr. Stirn put up fourteen of his lamps over the Madison Avenue entrance to the Garden on May 19th which create such a blaze of light that all of the adjoining park is illuminated and people have come over from Broadway and Fifth Avenue to see the attraction.

THE EDISON JR. ELECTRIC LIGHT & POWER COMPANY, 27 William St., New York City, have on exhibition their primary battery which furnishes power for all kinds of apparatus from a phonograph to a piano.

This battery differs from all other kinds of primary batteries in that there are no loose cells, no wires to connect and clean, no clamps, soldering, or binder screws. The battery is free from deposits of crystals or salts and can be placed in the hands of any intelligent person and handled without trouble; unlike the ordinary primary battery it requires no electrical knowledge to operate it.

Zinc, sulphuric acid, and nitrate of soda, are the only chemicals used and they leave no deposits of any description, either in the battery cells or in the walls of the porous cups.

The mechanical arrangements consist of the permanent connections between the cells. These connections are made at the bottom of the battery and are covered with an acid-proof cement, which renders corrosion impossible, and is at the same time a perfect insulator.

In the household the battery can be used as a hand or table lamp, or for lighting a carriage or stable, for running fans, sewing machines, grinding mills, pumping water, or doing light work of any description.

For professional and scientific uses there is no limit to its employment.

The company will at all times be pleased to answer enquiries as to the battery required to do any given work, and they invite correspondence on the subject.

BUSINESS NEWS.

SPECIAL EXPORT. COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING MAY 16, 1899, $89,765.00.

New York, N. Y., May 16, 1899.—The following exports of Electrical Material, Electrical Machinery, etc., are from the port of New York for the week ending this date:—

Argentine Republic:—308 cases electrical material $12,788.

Antwerp:—41 cases electrical material $1,015. 17 cases electrical machinery $412. 1 case electros $10.

British Australia:—1 case electros $30.

British East Indies:—176 cases electrical material $3,874.

British West Indies:—28 packages electrical material $514. 10 reels electric cable $3,379. 1 box electrical machinery $25.

Berlin:—3 cases electrical material $1,678. 1 case electrical machinery $300.

Bremen:—1 package electrical material $20.

Bristol:—11 packages electrical material $1,959.

British Posessions in Africa:—2 boxes electrical motors $321. 78 packages electrical material $13,489.

Cuba:—27 cases electrical material $1,936. 10 cases electrodes $6,000.

Central America:—1 case electrotypes $10. 20 packages electrical material $532.

Cassel.—1 case electrical material $138.

Dutch Guiana:—4 cases electrical material $706.

Hamburg:—50 cases electrical machinery $6,489. 53 packages electrical material $5,929.

Havre:—3 packages electric motors $330. 22 cases electrical material $2,573. 75 cases electrical material $2,733.

Hull:—1 case electric motors $26.

Lausanne:—106 cases electrical machinery $2,180.

Liverpool:—76 cases electrical material $1,185. 35 cases electrical machinery $2,235.

London:—56 cases electrical material $2,658. 1 case electrical machinery $60. 4 cases electrical carriages $3,850.

Mexico:—42 packages electrical material $522.

Moscow:—37 cases electrical material $2,347.

New Zealand:—1 case electros $8. 13 packages electrical material $341.

Naples:—1 case electrical machinery $150.

Odessa:—9 cases electrical material $802.

Rotterdam:—5 cases electrical material $240. 2 cases electrical machinery $400.

Southampton:—2 cases electrical machinery $3,656.

U. S. of Columbia:—195 packages electrical material $1,155.

Uruguay:—5 cases electrical material $300.

Zurich:—4 packages electrical material $460.

NEW INCORPORATIONS.

Chicago, Ill.—Chicago Electric Vehicle Transportation Company, incorporated by Carl Meyer, Charles R. Holden and Carey W. Rhodes; manufacturing and operating electric vehicles and automobiles. Capital stock $10,000.

Rochester, N. Y.—Elwood Electric Company has been incorporated by Alfred Elwood, Chas. A. Elwood and W. Irving Peacock. Capital stock $2,500.

New York, N. Y.—American Electrical and Maintenance Company, incorporated by Alfred K. Warren, F. James Reilly and William F. Reilly. Capital stock $50,000.

Granville, N. Y.—Granville Electric Light & Power Company, incorporated by Adolph Reomer, Eugene R. Norton, Emmett W. Wyman, James E. Norton and Joseph B. McCormick. Capital stock $80,000.

Jersey City, N. J.—Electric Automobile & Manufacturing Company, incorporated by C. P. Scott, F. W. Gaston and Edgar Runyon. Capital stock $100,000.

TELEPHONE CALLS.

Plainsboro, N. J.—Farmers' and Traders' Telephone Company, incorporated by Henry W. Jeffres, Enoch C. Mount, Catherine L. Wicoff, and John V. B. Wicoff; telephone business. Capital stock $3,500.

Minneapolis, Minn.—Le Sueur Telephone Company, incorporated by M. W. Grimes, H. F. Weis and John McKasy. Capital stock $10,000.

Hart, Mich.—Oceana Telephone Company, incorporated by J. W. Perkins, E. A. Fuller and L. P. Hyde; constructing and operating telephone lines. Capital stock $20,000.

Columbus, Ohio.—The Northwestern Ohio Telephone Co., has increased its capital from $10,000 to $20,000.

Mosheim, Tenn.—Mosheim & Lick Creek Telephone Co., incorporated by F. M. Bible, M. H. Kent, H. C. Myers and others. Capital stock $440.

Sparta, Ill.—Sparta Telephone Co., incorporated by J. Spronlin, M. Sproul and A. B. Sproul. Capital stock $5,000.

Leslie, Mich.—Leslie Telephone Exchange, incorporated by V. H. Grout, W. G. Stewart and W. F. Prescott. Capital stock $25,000.

Detroit, Mich.—Independent Construction Co., incorporated by L. G. Gorton, J. C. Daugiger and others; construct telephone lines, etc. Capital stock $5,000.

Owensboro, Ky.—The Green River Telephone & Telegraph Co., incorporated by H. K. Cole and others. Capital stock $5,000.

Palmyra, Va.—The Fluvanna Telephone & Telegraph Co., incorporated with C. E. Jones, President; William Sclatter, Treasurer, and L. O. Hayden, Secretary. Capital stock $5,000.

Owensboro, Ky.—The Harrison Telephone Toll Line Co., incorporated by John J. McHenry, I. C. Adair and J. W. Carter. Capital stock $3,000.

Pulaski City, Va.—The Wythe Telephone Exchange, incorporated by D. D. Hull, Jr., B. F. Garnett, B. Laughton and George M. Holstein. Capital stock $5,000.

Baltimore, Md.—The Baltimore Telephone Construction Co., incorporated by William F. Martin, Frank W. Wilkinson, Charles F. Taylor, Harry Rogers and Jesse Sugluff; construct telegraph lines. Capital stock $10,000.

Montevideo, Minn.—Citizens Telephone Exchange of Montevideo, incorporated by R. D. Zinbeck, Ole Johnsrud and others. Capital stock $25,000.

Sterling Center, Minn.—Sterling-Amboy Telephone Co. incorporated by L. W. Wells, W. Wells and others. Capital stock $10,000

Doylestown, Ohio.—Doylestown Telephone Co., incorporated by B. F. Pritt, S. H. Miller and others; telephones and telegraphs in Wayne, Summit and Stark Counties. Capital stock $5,000.

Avon, Ill.—North Fulton Telephone Co., incorporated by A. E. Hatch, F. E. Woods and H. F. Townsend. Capital stock $1,500.

STREET RAILWAY NEWS.

Jersey City, N. J.—Detroit & Port Huron Electric Shore Line Co., incorporated under the laws of this State, by Wolcott P. Robbins, John R. Tinmen and Henry P. Driggs; construct and operate electric railways, etc. Capital stock $125,000.

POSSIBLE INSTALLATIONS.

Greenville, S. C.—The Greenville Gas & Electric Light Co., plant has been purchased by the National Gas & Construction Co., of Philadelphia, who contemplate making considerable improvement in the light service and the development of the power capacities of the plant.

Jackson, Minn.—An electric plant will be established.

Danville, Ky.—The Mayor may be addressed concerning erection of electric light plant.

BUSINESS CHANGES.

Pana, Ill.—Consumers' Electric Light Co., dissolved.

The Electrical Age.

VOL. XXIII—No. 22 NEW YORK, JUNE 3, 1899 WHOLE No. 629

AMONG THE SOCIETIES.

CAPT. S. T. CARNES,
President of the National Electric Light Association.

REPORT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

CAPT. S. T. CARNES.

Capt. S. T. Carnes, the newly-elected President of the National Electric Light Association, was born in Somerville, Tenn., in 1841, but lived there only a few years, when his parents moved to Memphis, and his boyhood days were spent in that city. He is a graduate of Annapolis Naval Academy, and one circumstance worth mentioning in this connection is that he graduated in the same class with the now famous Admiral Sampson. This was in the class of 1857, and he soon left with the other Southern boys and came home to participate in the bloody conflict which was to follow. He acted for a short time as drill-master in Memphis, and was then elected first lieutenant of the light battery commanded then by Captain, afterward General, W. H. Jackson. Upon the promotion of the latter he was made captain of the battery, which was known throughout the war as Carnes' Battery. During all this time he held his commission in the Confederate Navy, and when the army was at Atlanta he made application for transfer, and the same was granted. Just before Lee's surrender at Appomattox he was appointed by the War Department as chief of artillery in Forrest's command in compliance with General Forrest's third request, but on account of the surrender he never reported for duty.

After the war he was married to Miss Kate Payne, of Macon, Ga., and the following year he moved to and lived in Macon until 1890, when he returned to Memphis. After engaging there in the paper business for a year, he accepted a position as secretary and treasurer of the Memphis Light & Power Company. In 1896 he was induced to run for and was elected to the position of sheriff of his county ,and after serving in this capacity for two years he declined to stand for re-election. After his retirement from public office he resumed his position with the Memphis Light & Power Company, which he now holds.

The twenty-second convention of the National Electric Light Association was held at Madison Square Garden, New York City, May 23-25th, 1899.

President A. M. Young opened the convention with the following address:

Gentlemen:

"In opening the twenty-second annual convention of your association, I take great pleasure in welcoming you to the City of New York. I shall not attempt to enlarge on the beauties, advantages and wonders of this great City, because you all know it stands first among the cities of this Country, and in many ways is the first City of the World—in electrical progress it has no equal. Within its limits are located thirty-five electric light stations, which furnish more than 1,000,000 incandescent lights and more than 30,000 arc lights, and at least 30,000 horse power in electric motors. The capital invested for carrying on this great business is nearly $100,000,000.

"It may interest you to know that in 1897, in the City of Brooklyn alone, there were ten street railway companies having 678 miles of track, and a capitalization of $55,000-000. In that year these railway companies carried 223,-180,504 people. To-day, every transit company in the Borough of Brooklyn is equipped or about to be equipped wiht electricity as its motive power, and the capitalization is $150,000,000, and 236,680,010 people were carried by this vast system in 1898. Electricity, together with the inventive genius of honored members of this Association only, has made this wonderful change possible.

"An editorial in one of the prominent Brooklyn journals speaking of the trolley, says: 'Their power-houses are performing heart like functions, they are now pumping the blood of the cities through distant arteries where the flow was sluggish—they carry life with them' I think not only are the trolley companies entitled to great credit for awakening the cities and towns all over this country to new life ,but the electric light companies are also entitled to great credit in brightening up these cities and towns, showing the outside world they are alive.

"The evolution in the electric light business has been wonderful. At the semi-annual convention of the Association held in New York, in August 1885, the question of large and small engines and dynamos was discussed, and the late R. T. McDonald, of Fort Wayne, stated his experience at Peru, Indiana: They were operating a large plant, something like 165 arc lights, with two large engines and two large boilers. After running them a short time it was found no money could be made operating in this way. Small engines were substituted, after which the company earned good dividends. In some of the large cities at the present time are being erected six thousand horsepower units of engines and dynamos, and in most of the electric stations throughout the country large engines and direct connected dynamos are the order of the day, and only by their use can the best economies be obtained.

"The successful development of high tension service is making it possible to utilize the water powers that have been so long undeveloped. This service is revolutionizing the power question as to manufacturing business in many of our prominent manufacturing towns, where formerly steam had been altogether employed. As we are all very much interested in the question of high tension service, I think we shall learn much that will be helpful to us from the papers to be read on this subject, and from the illustrated lecture which will be given at this session.

"It has been the aim of your President to secure for the benefit of the members of this Association, papers by some of its prominent members, on practical every-day subjects which are nearest the hearts of electric light men and which help them in the operation of their own plants, and prove to them the value of this Association. It will be very pleasing for you all to know that never in the history of the National Electric Light Association has its membership been so great, and never so much interest shown in its success. I sincerely hope the members will be very prompt at all the sessions, and that as many as possible will be present to listen to the valuable papers herein referred to.

"I now declare the Twenty-second Convention of the National Electric Light Association opened and ready for the transaction of business." (Applause.)

Letters of regret of their inability to be present at the meeting were read from Mr. Charles F. Brush, Cleveland, Ohio, Prof. Henry T. Bovey, Montreal, and Frederick Nicholls, Toronto, Canada.

The next business was a paper by Mr. W. Barstow, of Brooklyn, on "A Local Transmission System—Development and Operation." In the discussion on the paper, Mr. Barstow said that steam auxiliaries used about ninety pounds of steam per H. P. and the investment in the boiler was considerably increased over what it would be for electrical auxiliaries; the cost of the auxiliary depending on the style; in estimating the relative economy of the auxiliaries, about twelve per cent. of the total steam was used in the steam auxiliary and three per cent in the electrical auxiliary. Mr. Creden, of Chicago, laid great stress on the reliability of the operation of the steam auxiliaries, as opposed to the electrical auxiliaries, which are more liable to become deranged. In a plant operating the condensing system he did not think there was any field for the electrical auxiliaries. Mr. Walker, of Brooklyln, said that the Brooklyn station had in use both styles of auxiliaries ,and that the economy of the electrical auxiliaries comes in in connection with the economizer. If there are no economizers used with the electrical auxiliaries, the steam auxiliaries are more efficient. As far as the investment goes, the steam auxiliaries used with the economizers require the extra investment of the secondary heater, also the auxiliary steam pipe, which must be considered, and that more than offsets any extra cost which may come in as regards the electrical auxiliaries. Mr. Barstow, in answer to a question if, in the light of later developments, he felt justified in advocating 25-cycle machines for the class of work he is now engaged in, said that the question was carefully considered at the time of the installation of the system; the question resolves itself into one of whether you wish to retain the natural conditions which exist at the time, or whether you wish to change those natural conditions. In Brooklyn more than three quarters of the business is done with direct current, and the use of that current is increasing more rapidly than the use of the alternating current. They have 3,800 kilowatts in rotaries used to transform the alternating current into direct current. The entire alternating current system can be taken care of with about 600 kilowatts. There is no doubt that for a system which has one half or three quarters of its load in alternating current, that 60-cycles is preferable, where small rotary work is used, and also where the rotaries can be fed in on a system which is supplied by direct current from some other source; in other words, the performance of a rotary running on an isolated system is different from a rotary running in conjunction with storage batteries, or a system supplied with direct

current from some other source. A system which is operated perfectly, a water wheel system, should have no trouble with a 60-cycle rotary, but on a system on which one half of the load is alternating current, there should be little question about the advantage of a 25-cycle rotary. The constant current transformers for series alternating arc work are of the General Electric type, with the coil transformer at 60-cycles. Mr. Von Puhl, of New Orleans, said that they were also operating auxiliaries electrically in his station with good results; they also had the steam auxiliaries which were used in conjunction with the feed water.

The report of the Committee on Standard Rules for Electrical Construction, of which Mr. Brophy of Boston is chairman, was not presented. The secretary read a letter of invitation to the members to visit the stations of the Edison Electric Illuminating Company of Brooklyn. An announcement was made that there would be an automobile ride on Wednesday afternoon and a sail around the Harbor on Thursday afternoon, both for the ladies accompanying the delegates.

TUESDAY'S AFTERNOON session was opened by the reading of a paper on "Rotary Transformers and Storage Batteries, Related to Long Distance Transmission," by William Ispenard Robb, of Hartford, Ct. Mr. Edgar, of Boston, in discussing the paper, said that his company had five or six large storage batteries, some of which are located from the three-wire generating station, that it is rather difficult to charge them, and they have been discussing earnestly during the past year the question of the installation of an alternater for that purpose only. Their idea is to take up the easy end of it first, and transmit high-tension current to the various high-tension substations ,and then by means of converters to convert it into continuous current. The question of how to generate that high-tension current had been discussed fully, and seemed to resolve itself into one of putting in straight alternating dynamos, run by engines or dynamos generating both alternating and continuous current ,or taking the three-wire system in their large stations and transforming it by means of rotaries into high-tension, and by static transformers raising it and carrying it over the city. Mr. Ayer, of Boston, thought that the system outlined by Mr. Robb lifted a lot of troubles from the central station managers; it lets them get away with the direct current machines and use the alternaters ,and taking the alternating current stations where they have that installed and they are compelled to hang on to small units, they have now the opportunity of getting out. Mr. Robb, in answer to a question, said that the way in which they have operated their series arc lamps in streets in which there are no three-wire system, is by Brush and Excelsior machines, belted to the line shafting, and the line shafting being direct connected to one large 600 kilowatts synchronus motor. Operating under these conditions, it is necessary for them to supply to the synchronus motor 550 watts of alternating current for every nominal 1,200 candle power lamp operated. A year ago last month they installed as a trial the first 38-light constant current transformer which the General Electric Company built for operating alternating series arc lights. They proved so satisfactory and tested out so thoroughly, that during the Summer they placed an order for six 100 light transformers. They have been installed. Operating under those conditions they supply directly to each lamp 400 watts of alternating current, in that way saving 150 watts on every lamp. Mr. Wagner stated that in St. Louis they had from 2,300 to 2,600 series alternating arc lamps in constant nightly operation which have been perfectly satisfactory in every respect, to the city authorities and the citizens. The system is not absolutely as automatic as the one in Hartford, (Mr. Robb's system) but for the entire station output based on the arc lamps, incandescent lamps and power, they have only one switchboard attendant on watch and he is not kept very busy. Mr. Doherty, of Madison, stated that theoretically it was not possible to get the same photometric value on an alternating current arc lamp as on a series arc lamp, and he urged strongly the appointment of a committee to make photometric measurements to determine the relative efficiency of the two lamps. Mr. Robb answered that with the open air arc the mean spherical candle power is greater, but when you come to lights two or three hundred feet apart, it will be found that the difference in the darkest places in the street is not very marked between the open air arc and enclosed arc generally. Prof. W. E. Goldsborough, of Purdue University, Lafayette, Ind., then read a paper on "Transformer Tests." In discussing the paper Mr. Leslie of New York said that he had made tests of transformers in 1893, and the regulation and core loss at that time was very bad. He regretted to say that his experience with transformers indicated that the life of the transformer did not extend much beyond five years. Prof. Goldsborough agreed with the last speaker that the transformers built five years ago were probably worn out by this time. Such transformers heat up a great deal, and for that reason the insulation will tend to be impaired. It is a dangerous piece of apparatus, for the reason that it is not subjected to the high insulation tests now given to transformers, and it is probably defective from that point of view. The reason that many of the old transformers should be thrown away is that at that time the needs of the industry were not entirely understood. Transformers at that time were insulated against their own voltage, and not against high-tension crosses and shocks which they would receive from parallel line effects, etc. It is absolutely impossible to make a transformer puncture proof against lightning discharge, but a well insulated transformer may not offer as easy a path to the ground as a lightning arrester arranged at the end of the line. Mr. Rice, of Brooklyn, expressed the idea that the ageing process took place more from magnetic causes than from the heating, and he thought in order to secure ageing in an artificial test it was necessary to operate the transformers at higher magnetic density than that at which they were designed to run. Mr. Wagner said that he undertook three years ago, some tests to find out if possible what effect magnetic density had on the ageing of iron, and for that purpose took four transformers of the same size, same number of turns in the coils, but with a varying amount of iron—by taking off some of the iron the density was much increased in the remaining iron. Of the four transformers one was of normal density, and the density was increased from one to the other, until the fourth transformer had four times the normal density. The current was kept on the primary coils of these transformers continually for about three years and there was not enough difference to warrant anyone in drawing any conclusions as to the effect of increasing the density. He thought that the tests which Prof. Goldsborough had explained, showed that there had been a remarkable improvement in transformers in the last two years. Five years ago transformers kept in service the length of time that these were would have shown an appreciable increase in iron losses. Mr. Ayer thought it was fairly brought out that there was no peculiar phenomonon in the ageing of the iron, but it is pretty well known in mechanics that there is a radical change in iron at high temperatures. He thought the ageing effect was due to temperature and temperature alone. Mr. Wagner replied that in order to produce ageing from temperature it would be necessary to reach much higher temperatures than at which it would be safe to operate the wire Insulated with the ordinary material. Prof. Goldsborough said that if iron is heated to any point between 75 and 750 degrees there will be ageing, but that below or above those points there would be no ageing. The meeting passed a vote of

thanks to Mr. Barstow, Prof. Robb and Prof. Goldsborough for the papers that they had presented.

At the opening of Wednesday morning's session the secretary read a letter from First Vice-President E. W. Rollins, of Denver, regretting his enforced absence. Similar letters were read from Mr. L. A. Duncan, Birmingham, Ala.; C. H. Wilmerding, of Chicago, and Mr. Edward L. Nichols of Ithaca. A letter was also read from Mr. Marcon, of London, regretting that it was impossible for him to attend the meeting. Mr. Herbert A. Wagner then read a paper on "Single-Phase Distribution." In answer to a question whether there were any motors used on single phase distribution, Mr. Wagner said that there are a number of elevotor motors which run continuously and do not start and stop with the elevator—constant speed motors starting whenever they are wanted, and they are making a few installations with direct current variable speed motors. The motors are started and stopped without any effect on the lamps. Mr. Emmet said that the advantages of such methods of distribution are open to all, and they can be obtained at small cost for alterations, and existing methods of distribution, and they should be very carefully studied and adopted in other towns. Mr. Crosby of Washington, asked the question, "Are we going to get a satisfactory elevator motor out of the single phase system, and shall as many of us as have occasion to do it, restrict our direct current system if we have both, or shall we feel that as the city in which we are now operating grows, we ought to enlarge the direct current system?" In Washington there were currents on the Edison system, the single phase and the two phase system. When a new customer applies, and it is possible to give him either system, how shall he be supplied—with the direct current or the alternating current system? Mr. Wagner replied that in St. Louis they have found no class of work which they had not been able to do as readily with the single phase motors as with the direct current motors. At present the direct current motor is cheaper, but it does not work as well as the single phase alternater, and the question which system to adopt is for each one to decide. It would be desirable, however, to decide what is to be the standard system in the future and run into that and abolish everything else, and he believed that the alternating system could be safely used in all such cases. Mr. Ferguson of Chicago said that in Chicago where the territory is thirty three miles long, they had direct current for a length of seven miles, and the rest of the territory is covered by alternating current. At present it is single phase, some of it secondaries interconnected, but the bulk of it on the house to house transformer system. Mr. Wagner stated that in their outlying territory they had twenty H. P. motors on the alternating system and they had no complaint from the regulation. The amount of current thrown on and off the system at one time where the feeder is large must be a small portion of the maximum capacity of that feeder, or else variations are impossible to avoid. If the outlying distribution is for lighting in small quantities here and there and it is desired to put on large motors, it will be necessary to change the distribution very appreciably to get good service. Mr. Perkins, of Youngstown, said that he had been in St. Louis recently and when twenty-five H. P. motors were cut in on the single phase current there was absolutely no noticeable effects on the line. Mr. Emmet, of Schenectady, agreed with the last speaker and said it was a question of the system of distribution. If you put in enough copper and use high enough voltage, you can get any desired effect. The solution of the question of the use of alternating or direct current must always depend on local conditions. The paper of Mr. Louis A. Ferguson, of Chicago, on "Underground Electrical Construction," then followed and was illustrated by lantern slides. Mr. Gille, of St. Paul, remarked in the discussion that they had an extensive system of underground distribution and had considerable trouble with electrolysis and hardly knew what to do about it. Mr. Barstow said they had the same trouble in Brooklyn and had met with no solution of the difficulty thus far; but the trolley companies were doing a lot of renewal work to overcome the difficulty.

At the opening of the Wednesday afternoon session, Mr. A. E. Leslie, of New York, read a paper, "Some Notes on the Underground Distribution of Two-Phase Currents in New York City." There was no discussion on this paper, and it was followed by a paper on "Means of Attaining Safety in Electrical Distribution," by Mr. W .L. R. Emmet of Schenectady. Mr. Sachs, of New York, stated that there was great difference of opinion as to where to stop fuse protection and begin circuit breaker protection. He claimed to be able to produce a fuse that will break at any potential certainty, taking into consideration the Watt energy to be dissipated in the fuse, and he found the whole problem to be a question of the watt energy to be dissipated and the amount of metal in the fuse to be gotten rid of. Mr. Emmet replied that simplicity is the principal object in the fuse, but the circuit breaker is a better thing if it is satisfactorily designed. Mr. Barstow said that about a year ago he investigated the question of fuses and switches both at home and abroad. He found in a lot of instances through England that they were using fuses under oil, especially in Ferranti installations. These fuses were only used up to 3,000 volts and 800 kilowatts. In Milan he found they were using a fuse which was an ordinary tube and made of porcelain, which had been used on currents of 13,000 volts with fair success. Mr. Greene, of Schenectady, called attention to the necessity of having the rules of the Board of Fire Underwriters conform to the actual practice of electrical installation, and he moved that a committee be appointed to bring about this end, which motion was adopted. There was no report of the committee on "Standard Candle Power of Incandescent Lamps," and the committee was continued for another year. Mr. G. W. Hubley, of Louisville, read a paper on "Transformer Tests." The president announced that Calvin W. Rice, of Brooklyn, would give a lecture on "The Development of High Tension Service" in the evening.

The session of Thursday morning was opened by the appointment of Messrs. Ayer, Hubley and Fairbanks as a nominating committee. Mr. H. M. Atkinson, of Atlanta, Ga., read a paper on "Alternating Current Generation and Distribution—Changes Contemplated in Atlanta." A general discussion followed on the relative advantages of the alternating current and direct systems, as to which should be extended; the consensus of opinion being that individual conditions control this question. The matter of providing current for automobile service was considered to a very great extent—the general opinion prevailing that this would be a source of vast income to companies furnishing electric current and that it behooved the companies to make early arrangements for supplying this service. A resolution was passed of thanks to the various automobile companies which had supplied vehicles for the "Automobile Ride" for the ladies. Also a resolution of thanks to Prof. G. F. Sever, of Columbia University. At the afternoon session of Thursday, an invitation from the Edison Electric Illuminating Company of New York inviting the members of the association to visit its station, was read.

The matter of "Standard Specifications for Electrical Apparatus" and "Amendments to the Freight Classification." were discussed.

The report of the treasurer was read and showed the following financial transactions:

Receipts and cash on hand	$7,188.90
Disbursements and liabilities	4,551.85
Balance	$2,637.05

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THE POPULARITY OF THE CORPORATION.

Engineers have not escaped -the influence predominating in various industrial circles which cannot as yet be called good or bad that leads to consolidation. There is as much bonded wealth in the huge aggregations controlling the telegraph, telephone, street railway, electric light and power interest as represented by other huge corporations. Of course the greatest example extant of the principle of consolidation carried to its uttermost is the Standard Oil Company. This we can safely predict will be but a little fish in the near future as compared with those gigantic cephalogs due to the co-operation of a few of our largest industries. Were a monoply formed by which electric lighting could be done in every large city in the Union by one gigantic corporation the Standard Oil Trust would sink into significance. Yet this possibility is not so remote as would seem at first sight. Certain old and established industries have grown to very fair proportions. They may last for years, even a century, in normal conditions but the process of commercial disintegration is inevitable and then certain organic imperfections are discovered which cannot exist in those coordinated industries which are in every sense of the word supply an absolute necessity.

Were the manufacture of bread in the hands of one syndicate its autocratic power would be as great, provided it were allowed to continue its functions, as man could imagine. The lighting of a man's home and his transportation over small and great distances in a short space of time is now understood as another of the accepted necessities of life. Within the last five years or at the most within a decade electric light interests and street railway interests have begun to extend their ramifications all over the country. One of the most colossal trusts of the beginning of the new century will probably be a gigantic street railway corporation. It does not always follow that large trusts mean large profits. Their object in combining is to decrease the expenses and improve the business outlook by increasing the scope of operation. In the aggregate enormous balances in cash result at the end of each year's work but so many are concerned in a division of these profits that each on a pro rata basis receives but a moderate amount. What we wish to point out is the increasing tendency in engineering circles to carry on important manufacturing and industrial enterprises on a large scale by repeatedly consolidating. As far as we are concerned many advantages result from this process. Both the quality of goods, if the interests are of a manufacturing order or other prices if related to lighting or power or street railway enterprises are greatly reduced by this method of consolidation. In fact, it seems as though it led to a higher efficiency in commercial operations which certainly lead to a reduction in price commensurate with circumstances and therefore a direct gain to the every day customer. If consolidation does not mean monopolization in its blacker sense a host of benefits spring from it. It is otherwise a most natural process, practically an offshoot from the soil. All things carried to excess are dangerous to the community but in moderation they provide a source of happiness, as it were, which absolutely prevents those discussions frequently carried on by many of the so-called labor agitators. It seems obvious to a student of political economy that this welding together of corporate interests can only occur when conditions are propitious. In other words, with what is called business prosperity we generally find a long list of new incorporated companies.. This is certainly an indication that a healthy atmosphere prevails in these industrial circles. The last six months of this year provides an excellent illustration of this principle not only in various fields of work foreign to our own but within the very circles of home trade supported or at least developed by the electrical engineer.

KIPLING IN MINIATURE.

In a volume called "Engine Room Chat" we find an article headed "Electricity Direct From Coal" from which we give the following interesting extract: "yes, 'tis a consumation devoutly to be wished. But it is not in sight yet. The idea is that the energy which is evolved at present in the combustion of coal and which is so imperfectly utilized that the average steam engine only gives us about twelve and one half per cent. of the theoretical maximum that we should get should be set at work to produce electricity at once instead of having the steam engine turn a dynamo and lose part of the twelve and one half per cent. that was left for the engine to deliver as mechanical work. It is very well to say 'there is the energy' and that we should be able to use in one way or in the other just as we please, but in saying this we should not lose sight of the fact that before we think of doing a thing in either one of two or three ways we had better find out how to do it in that one of them with which we are best acquainted." This exceedingly sensible series of remarks are concluded by the following interesting paragraph: "it is probable that we will not have electricity direct from coal just yet a bit; but it is also possible that the electricians will get tired of being so handicapped by poor combustion and poor utilization of the heat of combustion and will be compelled to invent what they have been for so long talking about and thinking about—the principle of producing an electric current by the destruction of common, every day anthracite."

The officers for the ensuing year were then elected. President, W. W. Carnes, Memphis, Tenn.; Fist Vice-President, O. G. Crosby, Washington, D. C.; Second Vice-president, J. D. Cahoon, Elmira, N. Y.; Members of the Executive Committee, E. F. Peck, N. Y.; William M. Brock, Paterson, N. J.; C. E. Scott, Bristol, Ct. A vote of thanks was passed to President Young and the meeting adjourned.

AUTOMOBILES START FROM THE ELECTRIC SHOW.

The first automobile parade ever held in this city took place yesterday, with forty-four vehicles of every description in line, including dogcarts, coaches, road wagons and traps.

The parade was in honor of the National Electric Light Association, and the delegates filled the electric carriages.

Starting from Madison Square Garden at 3.15 P. M. the automobiles were piloted up Fifth avenue at high speed, the destination being Grant's tomb on Riverside drive. It required only two minutes for the forty-four vehicles to pass a given point.

A large crowd watched the start, a number of bicyclists followed the procession, and several thousand people were in waiting to see the finish.

Everybody was sure the party would circle about the monument. But the electricians turned into One Hundred and Nineteenth street and toward Columbia College and the crowd was much disappointed. There is a heavy grade between One Hundred and Nineteenth street and the monument and one man in the crowd insisted that the "juice" in the vehicles had been pretty well used up by the rapid run and that the drivers were afraid to "tackle the hill," fearing they might get stalled.

Automobiles Leaving Madison Square Garden.

Another man said this was absurd. He called attention to the fact that the automobiles daily make the trip to and around the Tomb and seldom get into difficulty.

At Columbia University the electricians were the guests of Prof. Seaver, of the Department of Electrical Engineering. The library, West Hall and gymnasium were thrown open to the visitors and later lunch was served in West Hall.

It was intended to return by way of the Park, but permission could not be obtained.

Volta, Inventor of the Voltaic Pile.

There were no accidents nor delays during the afternoon.

Among those in the automobiles were Alden M. Young, Henry Villard, Col. A. A. Pope, T. C. Martin, C. O. Baker, Jr., Geo. F. Porter, Luther Stieringer, Marcus Nathan, J. Godfrey, J. M. Hill.

Among the ladies were Mrs. J. Godfrey, Mrs. J. C. Young, Mrs. J. M. Hill, Mrs. Marcus Nathan, Mrs. C. L. Edgar, Mrs. Eckert Chandler, Mrs. H. C. De Camp, Mrs. W. L. Candee, Mrs. M. J. Insull, Mrs. W. J. Hawley, Mrs L. Cotkin, Mrs. W. S. Bartow, Mrs. Charles T. Hughes.

A NIGHT DEDICATED TO VOLTA.

On an unlucky day in the month one of the luckiest events in the world was celebrated. On Saturday night, May thirteenth, 1899, over five hundred people met in the concert hall at Madison Square Garden, where the Electric Show is taking place, to celebrate Volta's discovery of the electric battery, which antedated that period just one hundred years. Representatives of many Italian societies were present and President Dunn, the executive of the New York Electrical Society opened the ceremonies by an address which was followed up by Mr. Lieb, vice-president of the Edison Electric Illuminating Company and the builder of the first electric station of any size in Italy. Dr. Doremus was there, of New York College, who thought that Americans would honor themselves by honoring Volta in a practical manner. He suggested the erection of a fine monument of Volta. A letter from Thomas A. Edison was received which read as follows:

New York, May 11, 1899.

Gano S. Dunn, Esq., President New York Electrical Society:

Dear Mr. Dunn—I am in receipt of your kind invitation to attend the Volta Centennial excercises at the Electrical Exhibition in Madison Square Garden on Saturday, May 13. and regret my inability to be with you on that interesting occasion. I need hardly say that I am warmly in sympathy with the sentiment which prompts your society to pay this tribute to the memory of the great Italian to whose investigations and researches in electricity the world owes so much. The discovery of the primary battery or voltaic cell was one of the monumental landmarks in the advance of electrical science and application. During the memorable fifty years of the development of land and sea telegraphy, it was the one source of current. Without it the modern telegraph would not have existed, and without it the next step in the discovery of electro-magnetic induction could not have been made by Henry and Faraday, giving in turn the later electrical arts that are based upon the dynamo. And even to-day, cells of the general voltaic type remain the most simple, perfect and reliable instruments for electrical measurement that we possess.

I am glad to learn that your society is to send fraternal messages to the Italian electrical bodies and to the official Telegraphic Congress convening at Como, the birthplace of both Volta and the voltaic cell, and I would beg that I may be allowed the honor of associating myself wiht you in these expressions of cordial and hearty good-will towards the countrymen of one of the noblest pioneers of our electrical art. Believe me, yours very truly,

(Signed.) Thomas A. Edison.

TECHNICAL NOTES.

A NEW LIGHTNING ARRESTER.

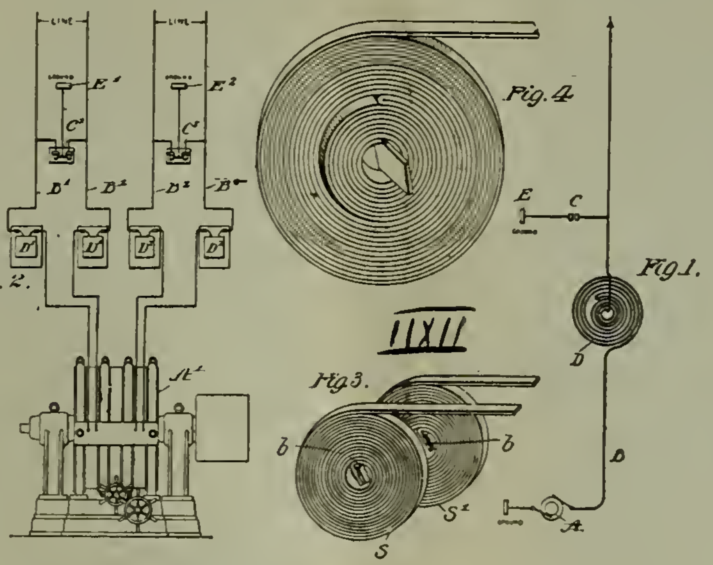
Cummings C. Chesney, of Pittsfield, Mass., has invented a lightning-arrester that can be used in connection with systems of distribution employing alternating currents as well with systems employing continuous currents.

The following is a description of the apparatus, reference being had to the accompanying drawings, in which

Figure 1 represents diagrammatically a simple alternating current system to which this invention is applied. Fig. 2 represents diagrammatically a system of two-phase distribution to which this apparatus is also applied. Fig. 3 represents the reactive of choking coil in perspective. Fig. 4 represents a modified form of the reactive or choking coil. Figs. 5 and 6 are respectively perspective and side views of the apparatus as actually constructed .

In Fig., representing diagrammatically a system of distribution of alternating electric currents, A is the apparatus to be protected, B is the line conductor, C is a lightning-arrester, one terminal of which is grounded at E in the ordinary manner. D is a choking coil placed in the line between the lightning-arrester C and the apparatus A to be protected.

It is immaterial whether the apparatus to be protected is dynamo-electric apparatus, such as a generator of motor, or whether it is electrical apparatus of some other kind. The advantages of the apparatus are, however, greatest when it is used in an alternating-current system, for reasons hereinafter set forth.



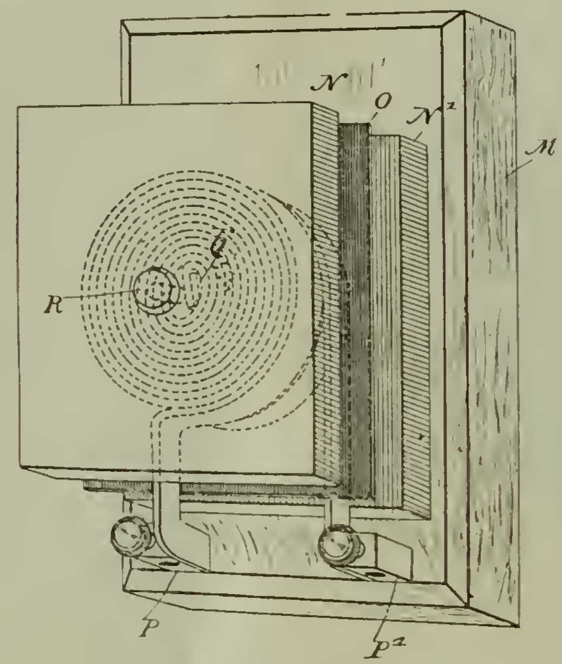
In order that a choking coil should act efficiently in connection with a lightning-arrester, it must offer as high an impedance as possible to the lightning discharge, so as to force it across the arrester-circuit and away from the apparatus to be protected. On the other hand, with alternating currents a high impedance, even though self-inductive, is very injurious, since a large self-induction in an alternating-current line lessens the output of the generator and impairs the regulation of the system. But coils made according to the following description, while possessing practically no self-induction with alternating currents of ordinary frequency, offer practically as high self-inductive impedance to extremely high frequency discharges, like those of lightning, as do plain coils, such as are now ordinarily used with lightning arresters.

The reactive coil consists of parts so disposed relatively to one another that the coefficient of mutual induction is very high. Fig. 3 represents such a coil, which consists of two parallel coils of insulated copper strips connected in series and wound so that the current flows through

them in opposite directions. These parts are placed near together side by side, with the result that the coefficient of mutual induction is very high, and in consequence with ordinary alternating currents the self-induction of the two coils is nearly zero. They thus constitute a composite coil which may be used in embodying the invention. As shown the parts are separated a considerable distance to get a better view, the connecting-bond being interrupted for that purpose. Fig 4 also represents such a coil. In this coil the insulated strip is all wound in the same plane, being wound one-half in one direction and the other half in the reverse direction. In this coil also the mutual induction is very high and the self-induction for ordinary alternating currents practically zero.

In embodying this invention there is placed a coil, such as one of those above described, directly in the line between the lightning-arrester and the apparatus to be protected, with the result of providing a high impedance for lightning discharges and yet not interfering with the working of the system, whether it be alternating or continuous.

Fig. 5.

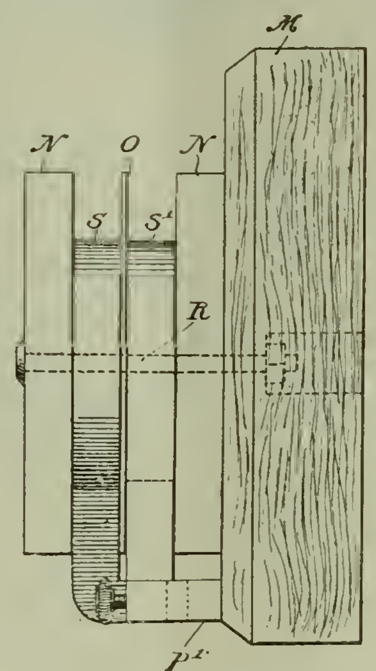


The fact that coils as above described offer practically as great an impedance to lightning discharges as do ordinary coils is probably due to the fact that with very high frequency discharges the phase of the current in the two parts of the coil is not the same at the same instant, and consequently because wound in opposite directions the currents exercise a reinforcing magnetic effect instead of a mutually destructive one. On the contrary, with alternating currents of the ordinary frequency the phase is practically the same throughout the whole length of the circuit, so that the resultant self-induction is practically zero. However this may be, the fact remains that the effective impedance of these oppositely-wound coils is very high for lightning discharges and the self-induction is practically zero for currents of ordinary frequency. In consequence it is possible in an alternating system to interpose a coil between the lightning-arrester and the machine to be protected which will offer no practical disturbing effect either as to magnitude of the output or regulation of the system and which will at the same time interpose an enormous opposition to the passage of lightning discharges toward the machine to be protected.

While the invention has more advantages in an alternating system, it is applicable to continuous-current systems and constitutes in that connection as effective an apparatus as that in which the plain coil is used.

In Fig 2 a two-phase system of distribution to which the invention is applied is represented, A is a two-phase alternating-current generator and is the apparatus protected by the lightning arrester. B1 B1 are the conductors for one of the currents. and B2 B2 are the conductors for the other. C1 C2 are the lightning-arresters, grounded at E1 and E2, respectively. D1 D1 and D2 D2 are four choking-coils, such as above described, placed directly in the line between the arresters and the generator. In this arrangement, as well as in that of Fig. 1, a current due to a static or other high-potential discharge will meet with such impedance, due to self-induction in the choking coil, that it will go to the earth by way of the lightning-

Fig. 6.



arrester circuit instead of going through the coils and to the apparatus to be protected.

Figs. 5 and 6 show the choking-coil as it is actually constructed. In these figures, M is the base, and N N1 are two boards between which are two coils such as are shown in Fig. 3, separated by some strong and comparatively thin insulating material O. Micanite gives very good service as a separating medium. The two coils are connected at their centers, the connecting-conductor or bond passing through the micanite. The two outer terminals are connected to binding-posts P P1, at which connections are made with the ends of the live-wires. The posts are held in position by a bolt R.

ELECTRO-THERAPEUTICS.

COMPLETE ELECTRO THERAPEUTIC OUTFITS.

The science of electro therapeutic has so far advanced that all progressive physicians provide themselves with electro therapeutic cabinets as an essential part of their workshop. The laboratories of the best physicians are generally provided with the very latest appliances required in electro therapeutic work. Some illustrations are givèn in this article of cabinets manufactured and sold by E. B. Meyerowitz, 104 E.23d Street, New York City. Messrs. Heuel and Vetter originally designed these cabinets. Their construction was further developed by the the above concern. The Edison current, to which by a simple connection with the ordinary lamp socket the following can be obtained

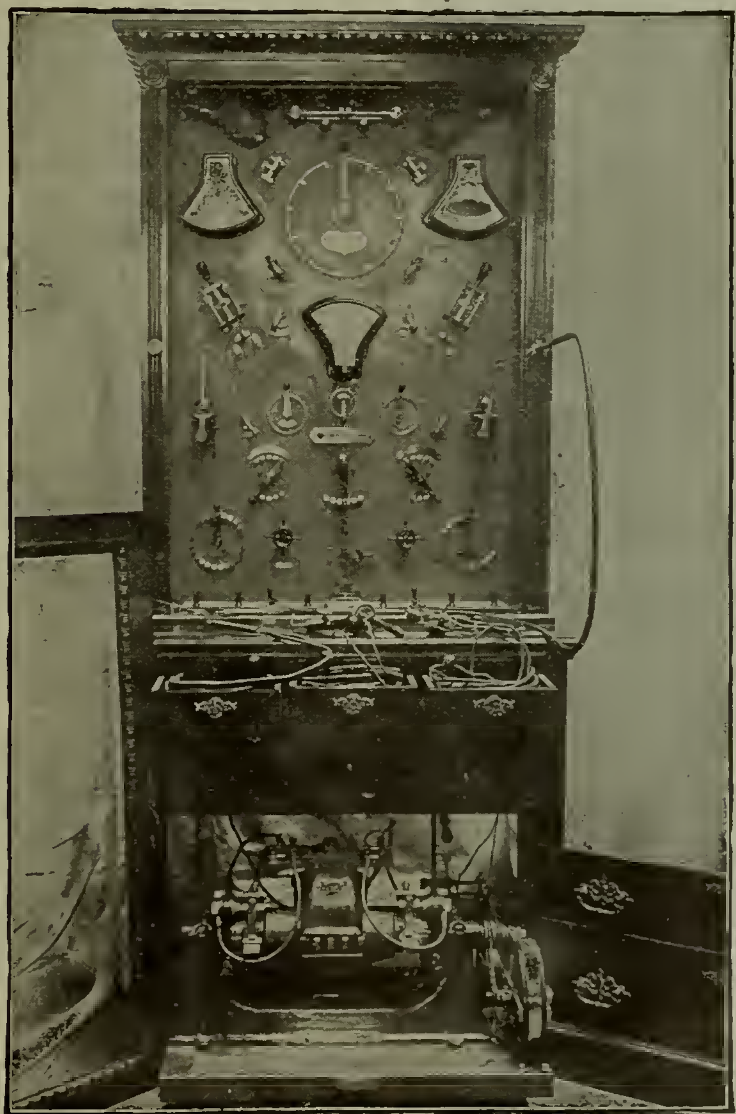
1. The galvanic current.
2. The faradic current.
3. Combined galvanic and faradic currents.
4. The sinusoidal current,
5. Various modifications of the above.
6. The cautery current, for heating electrodes and wire loops.
7. Current for the illumination of all kinds of diagnostic lamps from the smallest, as used in the cystoscope, to the largest of 100 candle-power for transillumination.
8. Motive power up to one horse for surgical drilling, sawing, etc.

Any and all of these currrents may be modified in any way desired.

The cabinet consists of an upper and lower compartment. In the upper compartment are the various translators, meters, switches, safety devices ,etc., fastened to a slate-back and base. To preserve them from dust and injury, they are protected in front by a removable plate-glass door, and in the back by a removable board. On the top of the cabinet is a fuse-box with cable connection for any ordinary lamp-socket. Also a vibrator bell for the "timing device."

The lower compartment, as shown in the illustrations, has above, a sliding shelf the entire width of the cabinet, for laying on instruments, etc.; below, a number of drawers for various articles to be used in connection with the cabinet. At the bottom is a removable front, made to represent two large drawers. Behind this are the motor, dynamo and alternator, on a separate moveable platform supported by heavy rubber-shod castors, so that they may be easily inspected or repaired without moving the entire cabinet, which is on separate rollers.

On the slate-base of the upper compartment are three sets of good sized binding-posts, connected below with three sets of conducting cards or tables, which roll up automatically on reels and are self-fastening, so that any length up to 20 feet may be used as required. When not in use the metal tips of each cable are placed in separate wooden grooves in the small drawers underneath each



Electro-Therapeutic Cabinets, Showing Meters, Switches, etc.

set of binding-posts, so that they are out of harm's way. The end of each conductor has a narrow red or blue collar interwoven to indicate its polarity.

The left-hand set of binding-posts and cable is for the cautery current; the middle set for galvanic, faradic, sinusoidal, or combined currents; the right-hand set for the illuminating current. In this arrangement the different currents can be used togethper or independently of each other. On the slate back are fastened:

1. The meters.

2. Rheotomes.

a Vibrator for galvanic current.

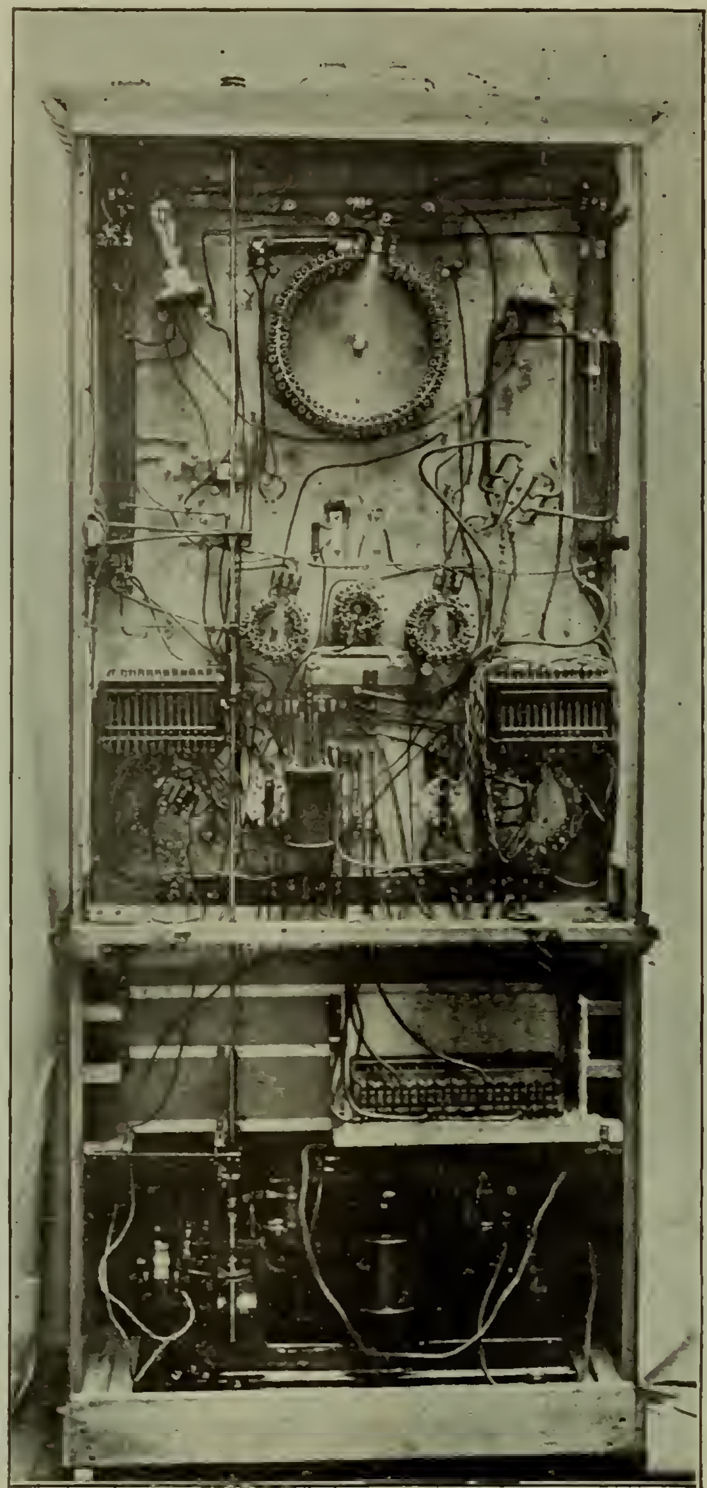
b Vibrator for faradic current.

c High tension ribbon vibrator for faradic current.

d Automatic clock-work vibrator for all currents, capable of from thirty to one hundred interruptions per minute.

3. Current selector switches.

a Switch for selecting the galvanic, faradic, sinusoidal or combined current.



Electro-Therapeutic Cabinet Showing Back Connections.

a A milliampere meter for indicating the current dose given to patients. It has three scales—the upper from one to twenty-five; the midle from ten to two hundred and fifty; the lower from thirty to seven hundred and fifty milliamperes, and is provided with a neat switch for placing it in or putting out of the patient's circuit and for selection of scale.

b A voltmeter to indicate the voltage used on patient's circuit or Edison main. In circuit is a "volt-equalizer" (Veter's) for use in case the voltage on the main line should exceed one hundred and ten volts.

c An amperemeter, which indicates the amperage consumed in driving the motor-dynamo and the amperage used for individual cautery electrodes or loops.

b Switch for selecting faradic coil, with buttons marked to indicate length and calibre of wire used.

4. Scale, with sliding button to indicate length of soft iron core within faradic coil.

5. A lever switch to regulate the speed of the motor-dynamo.

6. A commutator or pole-changer, over the middle set of binding posts, to indicate the direction of the current and change it as required.

7. A "timing device," which can be set to ring a vibrator bell on top of cabinet at the end of from one to thirty minutes, for timing the application of the current.

8. An "electro-thermal cut-off," which automatically cuts off the supply current from the cabinet at the end of

a specified time. In case the current should inadvertently be left turned on, there will be no waste of current.

9. Incandescent lamps for controlling the amperage of the various shunt currents.

10. A Vetter "volt controller" (large circular switch near top, between meters), by which any pressure from one to one hundred and ten volts can be obtained for the galvanic circuit. The amperage is regulated by a "Vetter carbon current controller" (in centre of slate base), through which from a fraction of a milliampere up to one ampere can be applied with absolute certainty and so imperceptibly that no sudden shocks to the patient are produced. This rheostat is always in circuit for the various currents.

The faradic current is gained through a long coil, made of wire of varying calibre and lengths, and tapped at different points. It is modified by the various rheotomes, volt aand ampere controllers, which give great range of current variations of quantity and quality, and precise dosage.

The sinusoidal current is obtained from an "alternator" operated by the "motor-dynamo." In addition to being controlled by the adjustable speed of the "motor" it may be modified by the automatic clock rheotome, volt and ampere controllers.

The "motor-dynamo," capable of developing one horse-power, and using from two to five amperes of current, also supplies a cautery current from five to sixty amperes, and twelve volts, which is under perfect control by a special rheostat. It also furnishes power for surgical drilling, sawing, etc., by means of the flexible cable attached at the middle and right hand side of the upper compartment.

The illuminating current is obtained from the main line supply and modified through the lamps and an appropriate rheostat.

Special attention is called to the facility of practically and scientifically manipulating the various electric currents, and the absolute safety with which the same can be applied through this apparatus.

MEMORIAL DAY SOUVENIR OF THE AMERICAN ELECTRIC WORKS.

The American Electric Works, of Providence, R. I., have sent out to their friends and customers a particularly and appropriate Memorial Dey souvenir, consisting of a steel plate portrait of General Ulysses Simpson Grant, the famous soldier of the War of the Rebellion. Accompanying the picture is a card containing a few data regarding this illustrious soldier.

EXHIBITIONS.

ELECTRICAL SHOW NOTES.

THE WAITE & BARTLETT MANUFACTURING COMPANY.—In the basement of Madison Square Garden a Waite & Bartlett static machine is to be found in operation daily and works wonderfully well in spite of the fact that the air is damp and conditions unfavorable to its operation. Some of the Waite & Bartlett machines made fifteen years ago are running to-day, giving every satisfaction. A large machine built by that company is operating in the Electric Show, producing half million volt destructive discharges. The Waite & Bartlett therapeutic exhibit is extremely interesting, the firm deserving considerable credit for the care and attention their display has received.

CHARLES CHAMBERLAIN.—The establishment of a press department in connection with public exhibitions is now considered an indispensable element of success. Mr. Charles Chamberlain, the chief of the press department of the Electrical Exhibition has been connected with the press of New York for ten years or more and identified with the large exhibitions given in Madison Square Garden. His experience as an editor and the good fellowship existing between himself and newspaper men makes it possible for Mr. Chamberlain to accomplish remarkable journalistic feats. The broad and compre-

CHARLES CHAMBERLAIN,
Press Department of the Electrical Exhibition.
(By Courtesy of The Fourth Estate.)

hensive advertising which the Electric Show received is entirely attributable to the earnest efforts of Mr. Chamberlain. He is one of the veterans of the press department having acted in that capacity for the Electric Show of last year, the dog show, military shows, etc., that have taken place. The "Fourth Estate" and "Journalist" speak highly of Mr. Chamberlain's abilities.

A THIRTY MILE TROLLEY.

The New York and North Shore Railroad is to be operated by electricity from a connection with the terminus of the Calvary Cemetery line of the New York and Queens County Railroad at Middle Village, and its line will extend through Newton, Richmond Hill, Jamaica, Flushing and Whitestone to Bay Side and Manhasset, a total distance of thirty miles.

BUSINESS NEWS.

SPECIAL EXPORT COLUMN.
TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR THE WEEK ENDING MAY 23 1899,
$80,960.00.

New York, N.Y., May 23, 1899.—The following ex-

ports of Electrical Material, machinery, etc., are from the port of New York for the week ending this date:—

Antwerp—1 case electros, $25. 38 cases electrical material $2,108.

Aden:—6 cases electrical material $116.

Argentine Republic:—28 cases electrical material $1,979. 14 cases electrical machinery $773.

British Possessions in Africa:—13 cases electrical material $397.

British East Indies:—22 cases electrical material $2,553.

British Australia:—1 case electrical material $12.

Berlin:—4 packages electrical material $2,650.

British West Indies:—4 cases electrical material $[illegible].

Brazil:—3 cases electrical machinery $142. 69 cases electrical material $2,313.

Bremen:—3 packages electrical material $135.

Cuba:—50 cases electrical material $1,406. 13 cases electrodes $7,050.

China:—12 cases electrical material $613. 29 cases electrical machinery $787.

Equador.—1 case electrical material $83.

Glasgow:—4 cases electrical material $330.

Hong Kong:—21 cases electrical material $753. 12 cases electrical machinery $830.

Havre:—27 cases electrical material $2,323. 4 cases electrical machinery $50.

Hayti:—5 packages electrical material $10.

Hamburg:—15 packages electrical material $1,267.

Japan:—55 cases electrical material $1,600. 104 cases electrical material $8,022.

London:—286 packages electrical material $9,881. 3 cases electric motors $500.

Liverpool:—1 electric crane $3,500.

Moscow:—3 cases electrical material $192.

Mexico:—429 packages electrical material $11,620.

Nice:—64 cases electrical material $12,970.

Newcastle:—1 case electrical machinery $80.

Peru:—10 packages electrical material $298.

Rotterdam:—2 cases electrical material $100.

Southampton:—6 cases electrical machinery $196.

Siam:—26 cases electrical material $1,335.

U. S. of Columbia:—29 cases electrical material $750.

Venezuela:—8 packages electrical material $265.

Vladivostock:—7 packages electric motors $800.

NEW INCORPORATIONS.

Portland, Me.—United States Electrical Signal Co., incorporated by F. E. Withee, J. R. Devine, C. E. Rand and others; manufacture electrical signals, etc. Capital stock $50,000.

Pierre, S. D.—The Indiana Chemical Light, Heat & Power Co., incorporated by Albert Mellen and others. Capital stock $30,000.

New York, N. Y.—Perret Storage Battery Co., incorporated by Frank A. Perret, O. T. Hibbard and J. L. Kornicken. Capital stock $100,000.

Portland, Me.—Boston Electric Switch Co., incorporated by Robert T. Johnson, Archie F. Maclead, Franklin Jacobs and others. Capital stock $50,000.

Athens, Tenn.—East Tennessee Light & Power Co., has been incorporated by W. R. Hall, J. E. Hall, B. M. Brewer, H. S. Bosler and W. B. Swaney; manufacturing electric light and electric motive power. Capital stock $10,000.

Tiverton, R. I.—Tiverton Electric Light Co., has been incorporated by J. R. Hicks, G. R. Lawton, R. J. Barker, J. H. Wilcox, R. J. Barker, Jr., dealing in electricity, electrical instruments, etc. Capital stock $100,000.

Norwalk, Conn.—Norwalk Heating & Lighting Co., incorporated under the laws of West Virginia, by J. D. Kinney, M. H. Glover, and others. Capital stock $60,000.

Niles, O.—Niles Electric Co., has been incorporated under the laws of West Virginia by E. A. Wilson, F. E. Wilson, Mrs. Nancy Wilson, Etta M. Wilson, and Emma W. Wilson, furnishing light, heat and power. Capital stock $20,000.

Athens, Tenn.—The East Tennessee Light & Power Co., has been incorporated by W. R. Hall, J. E. Hall, B. M .Bosier and W. B. Swaney; for manufacturing electric light and electric motive power. Capital stock $10,000.

TELEPHONE CALLS.

Winston, N. C.—The Mutual Telephone Co. has been organized to construct a line from Winston to Elkins, to Wilkesboro.

Bristol, Tenn.—The Virginia & Tennessee Telephone Co. has been incorporated with a capital stock of $50,000.

Collinwood, O.—Collinwood Home Telephone Co. has been incorporated by W. G. Patton, J. B. Wood, J. B. Durkin, J. M. Hard and E. L. Barber. Capital stock $25,000.

Baltimore, Md.—The Maryland Telephone Manufacturing Co., of which David E. Evans is president, will increase its capital stock from $20,000 to $50,000.

Buchanan, Va.—The Botetourt Telephone Co. will apply for charter, with a capital of $2,000.

Mosheim, Tenn.—The Mosheim & Lick Creek Telephone Co. has been incorporated by F. M. Bible, M. H. Kent, H. C. Myers, Noah C. Bible and J. W. Cloyd, for the construction of telephone system in Green County.

Allegheny, Pa.—American Telephone Co. has been incorporated by Xavier Wittmer, H. Wittmer and others. Capital stock $1,000.

STREET RAILWAY NEWS.

West Chester, Pa.—The West Chester, Kennett & Wilmington Electric Railway Co., incorporated with George W. Taft, president; to build an electric line eight miles long. Capital stock $50,000.

BUSINESS CHANGES.

Galesburg, Ill.—Galesburg Gas & Electric Light Co. has increased its capital from $200,000 to $350,000.

Salisbury, N. C.—The Salisbury Light, Heat & Power Co. has been incorporated with a capital stock of $10,000 and privilege of increasing to $100,000, its purpose being the construction of the electric lighting plant.

POSSIBLE INSTALLATIONS.

Durant, Miss.—An electric light plant will be established at this place.

Summit, Miss.—An electric light plant will be established.

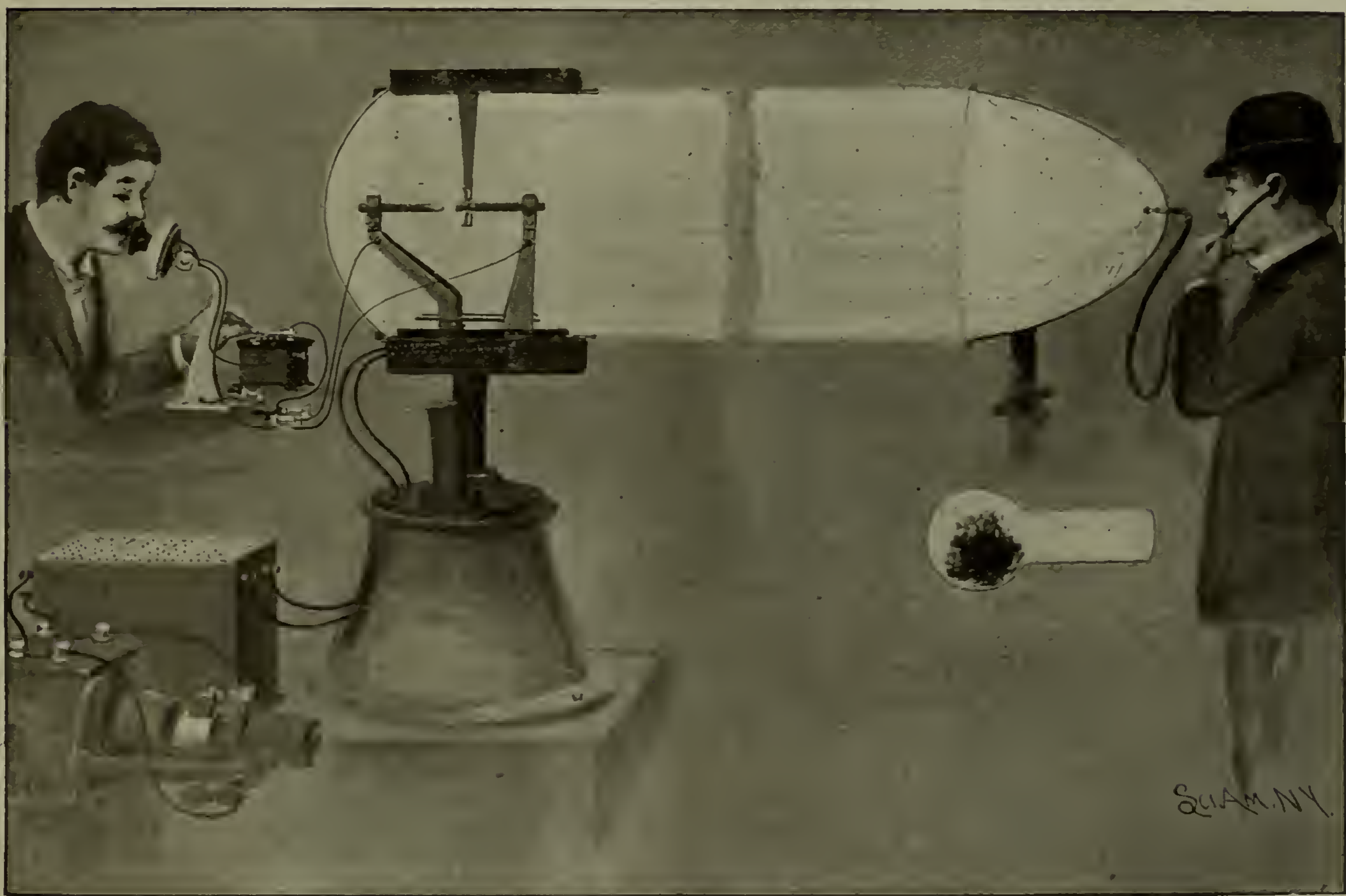
Louisburg, N. C.—J. M. Allen is interested in the proposed establishment of an electric light plant.

Jennings, La.—The Mayor may be addressed concerning construction of an electric light plant.

The Electrical Age.

VOL. XXIII—No. 23 NEW YORK, JUNE 10, 1899 WHOLE No. 630

TELEPHONY.



The Radiophone in Operation.

THE RADIOPHONE AT THE ELECTRICAL EX HIBITION.

(From the "Scientific American.")

Interest in the electrical show at the Madison Square Garden, in this city, continued unabated. On May 13 the first exhibition of an improved form of wireless telegraphy took place, which attracted considerable attention on account of its novelty and simplicity. It is an apparatus for transmitting varied heat waves in a beam of light to a receiver capable of reproducing the highest sound vibrations with accuracy.

Referring to the illustration representing the way the apparatus is arranged, there will be noticed on the left the generator, next to it a rheostat for adjusting the supply of current to the arc light located inside of a parabolic reflector fixed to project a parallel beam of light in the usual way. A shunt wire runs from each terminal arm of the carbon holder to a knife switch, and from that one wire goes to the base of the usual telephone transmitter arm, while the other is connected to a small resistance box with a regulating switch to adjust the strength of the current to the transmitter. From this resistance box the wire is connected to the other side of the transmitter. Instruments located in this shunt circuit indicated a current of four or five amperes with a voltage between forty and fifty.

When the transmitter is vibrated by the sound of the voice, or of a musical instrument, the current flowing through the shunt circuit varies to correspond, and this varies the main current, passing directly between the carbons. In the focus of the receiving parabolic reflector is placed a glass bulb holding a small quantity of carbonized filament (this will be seen enlarged at right of the

picture). From this bulb a tube runs through the back of the reflector and is connected by a rubber tubing to small ear phonograph tubes.

At the time we heard it a cornet was playing in front of the transmitter; the notes came out clear and distinct in the parabolic receiver about 350 feet distant, and about one-third as strong in volume as the sound heard in the ordinary electric telephone receiver. The fluctuation of the temperature of the fiber in the bulb due to the variable impinging heat waves causes like fluctuations of the volume of air in the bulb which acts upon the drum of the ear. The light is only projected for brief intervals at a time, as a continuous heating of the carbonized fiber reduces the sound. The instruments are placed in the regulation telephone booths, one side of the booth being partly open to allow the electric light beam to freely pass. It is said that signals and speech have been transmitted a distance of two miles from a vessel to the shore, by means of larger and more powerful searchlights.

ELECTRIC LIGHT AND POWER.

ROTARY TRANSFORMERS AND STORAGE BATTERIES, AND THEIR RELATION TO LONG-DISTANCE TRANSMISSION.

By Prof. W. L. Robb.

Read Before the National Electric Light Association at Its Twenty-second Convention, Held at New York, N. Y., May 23, 24 and 25, 1899.

This paper was prepared in response to a request from the President to give an account of the operation of the rotary transformers and storage battery installed and operated in connection with the long-distance transmission plant at Hartford.

The paper is intended as a statement of the conditions under which we operate at Hartford, of the difficulties met with and the advantages that have been found in the operation of the rotary transformers and battery.

A short description of the Hartford plant seems essential to a clear understanding of the conditions under which the rotary transformers and battery are there operated.

The main source of power is water power on the Farmington River, approximately eleven miles from Hartford. The water power at present developed is capable, under the most favorable conditions, of delivering at the switchboard in Hartford about twelve hundred electrical horse power. The power is generated by two 600-kilowatt alternators and transmitted to Hartford on the three-phase system under 10,000 volts pressure.

The water power is supplemented by an auxiliary steam plant in Hartford, consisting of two compound-condensing Couper-Corliss engines, having a combined capacity of 1,600 horse power. These engines supply the power to operate one 600-kilowatt alternator and one 400-kilowatt rotary transformer, so arranged that it can be connected with engines and operated as a direct or alternating-current generator. This rotary is so operated whenever, owing to low water or repairs on the transmission line, the supply of alternating current is insufficient for the alternating-current load and all the rotary transformers.

Two systems of distribution are used. In the central portion of the city the distribution is on the three-wire, 220-volt, direct-current system. This part of the service is practically all under ground. The feeders are lead-covered cables drawn in cement-lined ducts. The distribution is in part by Edison tubes and in part by lead-covered cables drawn in ducts. Outside the central portion of the city the feeders are supplied with two-phase alternating current under 2,400 volts pressure, and the distribution is, in general, on three-wire, 220-volt systems, supplied from ten or twenty-kilowatt transformers, although a few smaller transformers are still in service. This service is in part under ground, but, in general, overhead. Constant-potential, inclosed-arc lamps, incandescent lamps and motors, in the case of both alternating and direct currents, are operated on the same three-wire system. All the commercial arc lamps, whether on the direct or alternating system, are of the constant-potential, inclosed type, as are also the street lamps in streets in which there is a three-wire system. In other streets the street lamps are of the series alternating current, inclosed-arc type, and are operated from constant-current transformers.

Three rotary transformers supply direct current to the three-wire, direct-current system. One has a capacity of 400 kilowatts, and is located at the steam plant. Two have a capacity of 250 kilowatts each, and are located in a battery sub-station which is situated in the very heart of the business section of the city, and about three-quarters of a mile from the steam plant. The storage battery has a capacity of 2,500 horse-power-hours at a five-hour rate of discharge. The 250-kilowatt rotaries and the battery were installed in the fall of 1896, and the 400-kilowatt rotary in the fall of 1898. All three rotaries and the battery supply currents to the same three-wire system.

The three alternators are always operated in parallel. At least one rotary transformer and storage battery are always connected to the three-wire, direct-current system. The direct and alternating-current systems are consequently interlocked, and the whole plant, including alternators, rotary transformers and battery, is practically operated in parallel.

The rotary transformers are of the two-phase type, and are so designed that by cutting in or out turns of the primary of the static transformers the voltage of the rataries may be varied between 230 and 360 volts. This wide range of voltage is necessitated by the fact that the rotaries are at times run directly on the line, and at other times used in charging the battery, frequently at high charging rates. This wide range of voltage that can be obtained from the rotary does away with the boosters, otherwise necessary in charging.

The rotary transformers are two-wire, and simply supply the current to the outside wires of the three-wire system. The neutral wire is connected with the middle point of the secondaries of the two static transformers. This point is always midway, as regards electric pressure, between the two terminals of the rotary transformer.

The storage battery is at all times kept on the line for the purpose of regulation, and to meet any emergency call for extra power.

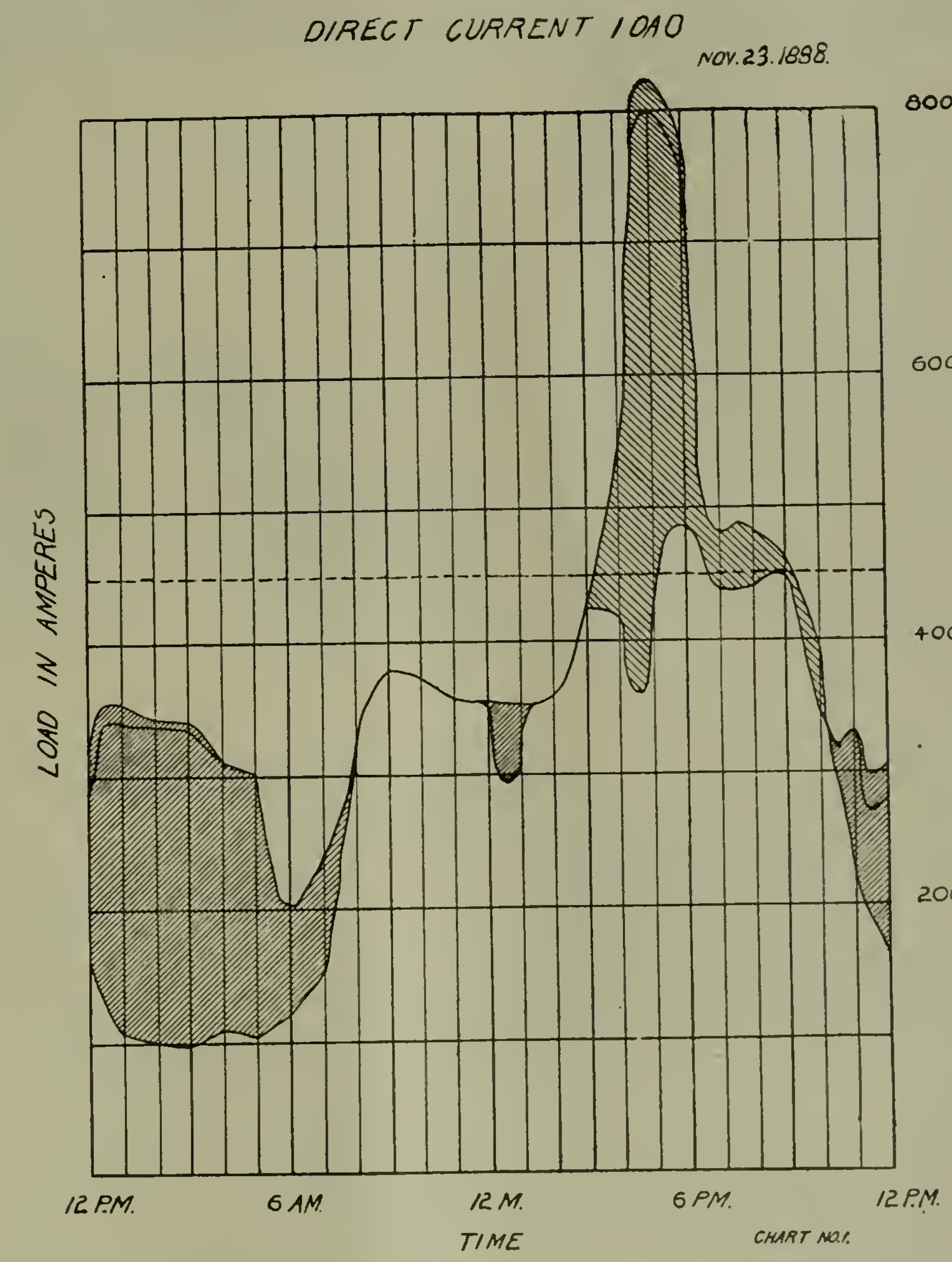
It was necessary to generate alternating current rather than direct current, as the main source of power is located eleven miles from the center of distribution. This condition very generally applies to water powers that have not already been developed for other purposes than the production of electricity. The same condition applies in the case of companies supplying large areas when it is desired to supply all the power from one central power plant, so located that the power can be produced at the minimum cost. In the Hartford case, at the auxiliary steam plant, one generator supplies alternating current. The second generator, which in its normal use is a rotary transformer, when supplied with mechanical power from the engines, furnishes both alternating and direct current to the system in any proportions that may be desired.

Two of the rotaries are started and brought into synchronism by induction motors built on their shafts; the third is brought into synchronism as a direct-current mo-

tor, the current necessary for this being supplied from the direct-current system.

The direct-current system of distribution was adopted for the central portion of the city, as it was considered the only one on which all kinds of service could be given from the same wires, especially if those wires were placed underground. In that section of the city a large number of motors are being frequently stopped and started. It is considered that induction motors operated under these conditions would seriously interfere with the lighting service. In sections of the city where the motors are in continuous use—for example, when they are used for running machinery in factories, and consequently are only started twice a day—we find no practical difficulty in operating induction motors and lights from the same system of distribution.

When brushes treated in this manner were used all vicious sparking was stopped, and in this particular the transformers ran as smoothly as direct-current generators of the best type. At the outset, in operating the rotaries, considerable difficulty was met with in preventing pumping when the engines were supplying power to the system. This pumping could be traced to the variation in the angular speed of the engines and when the water power alone was supplying the power there was little, if any, pumping. It was found that this tendency to pumping could be checked by varying the field excitation of the rotary transformers or by temporarily throwing a portion of the load on the storage battery. Only once in the past three years has the pumping been such as to cause any serious interruption. The switchboard at the sub-station was originally arranged to give the greatest possible flex-



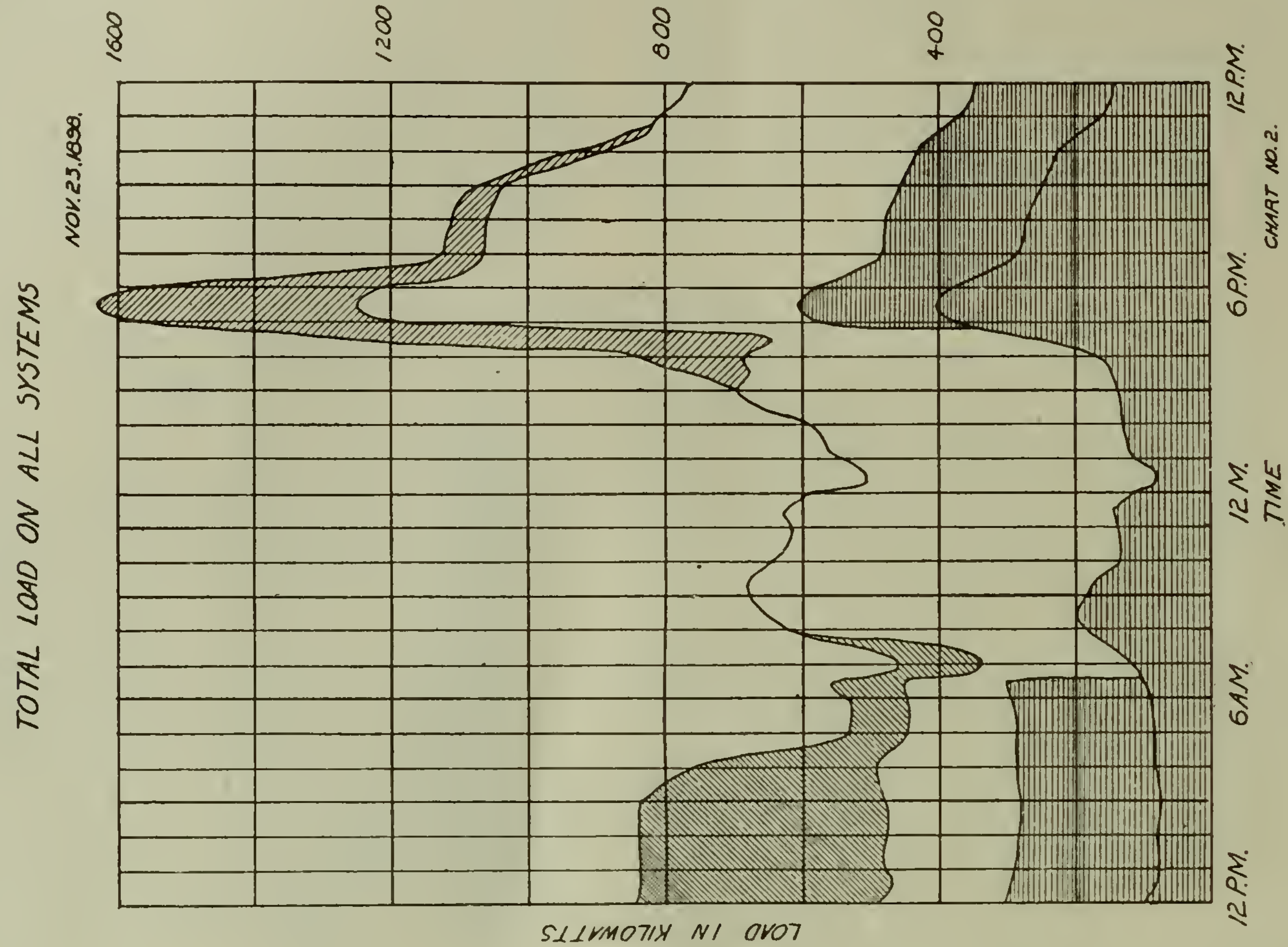
The three alternators, one operated by steam and the other two operated by water power at a distance of eleven miles from the first, have been continuously run parallel during the past three years. No difficuulty whatsoever has been found in this method of operation.

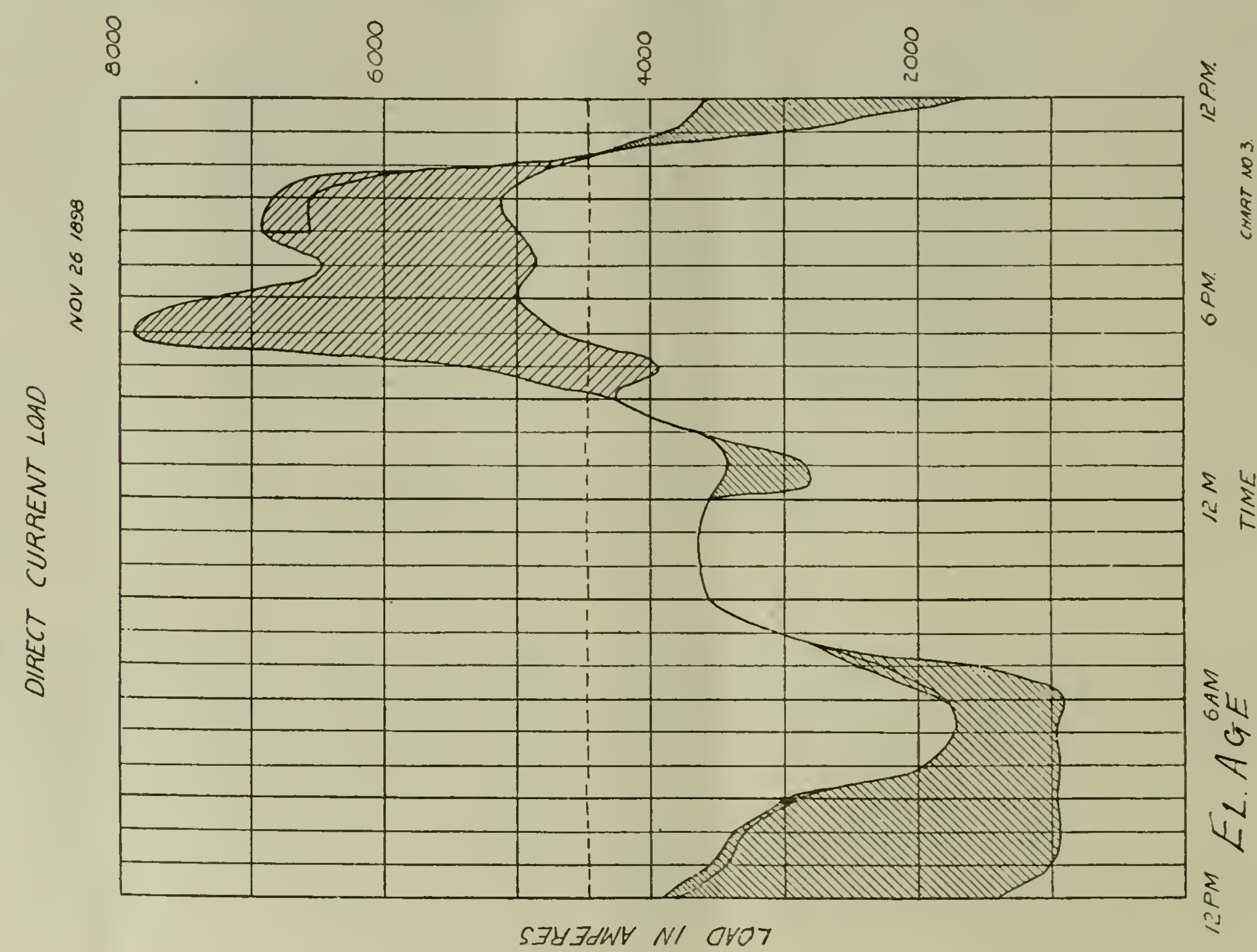
The operation of the rotary transformers has not been so simple a matter. At the outset there was great excess of sparking at the commutator. This sparking was soon found to depend very largely on the variety of brushes used. It was found that a very soft carbon brush gave the best results, but without special treatment of the brushes, sparking, although diminished, is still excessive. The method of treating the brushes suggested by our superintendent, Mr. Rollins, was tried and found effective. The carbon brushes are first raised to a red heat, and then plunged in ordinary lubricating oil and allowed to cool.

ibility in operation. Both rotaries could be run in multiple, with the battery, or both rotaries could be run in multiple, feeding into the line, and the excess of current used to charge the battery; or one rotary could be run on the line and the second rotary used to charge the battery independently. This last method of operation was found impracticable. Under this condition the pumping would immediately begin, and it necessitated giving up this method of operation. Notwithstanding the above-mentioned difficulties, when a year ago it was decided to increase the direct-current machinery, we had gained sufficient confidence in the rotary system to purchase a 400-kilowatt rotary rather than a direct-current generator.

The third rotary, when tested, proved to be free from any tendency toward pumping, either when operated from the steam plant or from the water power, and was in every

way as nearly perfect as a machine could be. However, when thrown on the line with the two older rotaries, they immediately began pumping, and it was found impossible to run the three rotaries together. The pumping in a rotary system seems to be cumulative; it is very easy to stop it if the proper remedy is applied as soon as the first tendency to pump is noticed. If allowed to go on it quickly gets beyond control. The impossibility of running the three rotaries together necessitated some change. The Westinghouse Company's engineers maintained that the corrective device could be applied with equal effect to any one of the three rotaries. Copper strips were attached to the pole-pieces of the 400-kilowatt rotary. This rotary, of itself, was all right, but the developing of any tendency of the system toward pumping was entirely overcome by means of these copper strips. The system now works perfectly, whether operated by steam of water power. Even under the trying conditions of running the rotaries under different voltages, two feeding directly into the line and the third independently charging the battery, no trouble with pumping is experienced. In all other respects the rotary transformers have been all that could be asked for; they have run practically continuously night and day for nearly three years and have had practically no repairs, the commutators simply being turned down once or twice a year.





With storage batteries one looks for frequent renewals of plates. The Hartford battery has had its share of re-

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CONTENTS. PAGE

SIMULTANEOUS TELEPHONY AND TELEGRAPHY.

Mr. Chas. Selden is the author of a paper on "Simultaneous Telephony and Telegraphy," read before the Association of Railway Telegraph Superintendents, at Norfolk, Va. The author states as follows: "In the fall of 1895 or in the spring of 1896 I was assigned to the duties of experimentation upon the line of simultaneously telephoning and telegraphing by the method invented and patented by Francois Van-Rysselberghe, of Belgium, an electrician and scientist who held a professorship in the University of Ghent and was attached to the Belgian Court."

The author further states that the system perfected by the above gentleman was brought to this country for the purpose of selling it. The idea of the "composite circuit" is involved in a system of this description, which is certainly the foundation upon which any future system must rest. It seems that a Prof. Rosebrugh took out a patent in Canada, the object of which was the duplexing of telephones. The results were apparently the same as those obtained by Van-Rysselberghe, although the systems were certainly different.

Quoting again from the author, the following paragraph appears to be quite descriptive: "In order to operate simultaneously and thus form what is now known as a composite circuit it was necessary that the abruptness of the wave caused by the Morse signal should be reduced upon the lines to be used simultaneously for telephone purposes, so that although the waves might traverse the windings of the telephone, the diaphragm would move so slowly as to be at a rate which the ear would not discern in contradistinction to the more acute or rapid vibrations or waves caused by the transmission through the means of a transmitter."

The author then discusses instruments called "graduators," which are coils of wire of a fixed resistance and operating a small iron armature so as to form a closed magnetic circuit. Each wire being graduated, so to speak, took away from the Morse signal its tremendous acuteness, thereby making it possible to listen to the signal. Experiments of this kind were carried on a distance of one hundred and ninety-five miles between the towns of Baltimore and Cumberland. According to the author, speech between three hundred miles was not distinct, and at an increased distance of four hundred miles speech became so unsatisfactory as to be practically impossible to understand.

Some experiments of interest were attempted in this direction, as, for instance, a test made between New York and Chicago. An outfit was placed in the Palmer House, Chicago, and in a room on Broadway, New York. According to Mr. Selden, the telephonic communication was very satisfactory, the wires being quadruplex during the test. A series of experiments is further cited by our friend which seems to show that the possibilities of telegraphing and telephoning at the same time in the manner described are very great, with direct practical advantages.

This most unique subject is well worth considering by the scientific as well as the practical world, as it involves some propositions which require careful consideration and study.

The author concludes his article, which is an excellent one, in the following manner: "One thing desirable in the composite circuit is some sort of a signalling apparatus whereby the telephonic stations may signal from one to the other without interfering with the Morse circuit. At present, in our experiments, it is necessary for us to call on the Morse circuit in order to notify the parties to go to the telephone. Doubtless, as the composite becomes better understood the inventive ingenuity of the American, which appears always to be at hand and always to arise when emergency occurs, will promptly supply this one missing link which at present is beginning to be needed and which in the future will certainly be to a large extent."

This departure in telegraphy, which means a new method of utilizing both the telephone and telegraph in conjunction, will certainly add to the widespread usefulness which each individually enjoys at present. As the ideas of mankind unfold our signalling and telephonic systems will become more and more perfect, ultimately attaining that marvelous excellence which has always been the necessary outcome of systematic applied intelligence.

THE ZINC LEAD BATTERY.

In a volume by Rainier we find many references to the voltaic accumulator which to the French mind seems to solve many important problems. It is hardly necessary for us to enter into a discussion of the technical qualifications of this hybrid type of cell. Yet it seems quite certain from what has been done in practice and theory in this field of work that the voltaic accumulator or zinc lead battery is destined to play an important part in the economy of electrical engineering. Weight for weight and output for output, an unquestioned superiority exists in the construction and operation of the voltaic accumulator. As far as its durability is concerned it, in its way, exceeds that of the storage battery proper. It is within the direct range of probability that automobiles and many light electrical vehicles will in the near future make use of this interesting and novel type of cell.

newals. The battery was bought under a five-year guarantee, which has since been renewed for five additional years. The renewals have not been in excess of what was expected, and no investment of the company has been considered more satisfactory than the battery. The method of deciding when the battery is to be renewed under the guarantee is perhaps interesting. Whenever any plate or number of plates have lost one-third of the original capacity, they are replaced by new plates. In this way the battery is being continually renewed, and its capacity should never be less than ninety per cent. of its original capacity.

The four accompanying charts, made from the daily records of the company, were originally prepared for illustrating a short talk before the Connecticut Association, and illustrate the general operation of the plant and the relative loads on the different systems. The charts represent the load on Wednesday, November 23, and Saturday, November 26, 1898.

The part shaded with horizontal lines represents the alternating-current load, the upper portion representing the series arc street lights. The part shaded with diagonal lines represents the charge and discharge of storage battery; lines sloping to the right representing the discharge, and lines sloping to the left the charge. The horizontal dotted line represents the total full-load capacity of the direct-current machinery installed on November 23. The unshaded area represents the direct-current load carried directly by the rotary transformers.

An inspection of the charts representing the direct-current system shows that the average load on the rotaries during the twenty-four hours was over eighty per cent. of their rated full-load capacity. The maximum load on the system was eighty-three per cent, more than the full-load capacity of the rotary transformers.

A comparison of the curves for the two days illustrates the great flexibility of the storage battery. On Wednesday it was used at the high rate of discharge for a short period. On Saturday the discharge was at a lower rate, but was continued for a much longer time.

The upper portion of the area representing battery charge and discharge represents the charge and discharge of an isolated storage battery in one of the department stores.

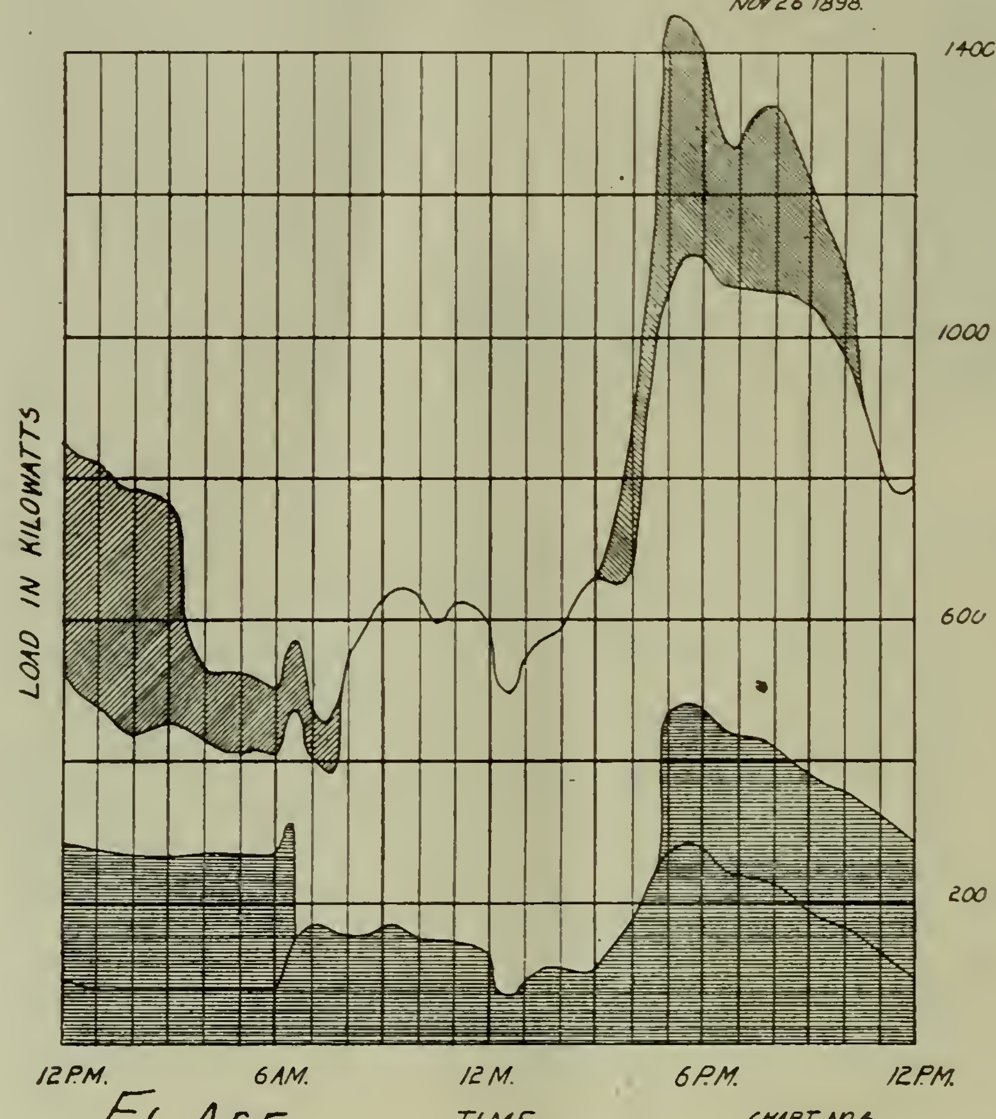
The advantages of the rotary transformer and battery system to the Hartford company have been very great With the battery the company has been able to use a great quantity of water power that would otherwise have gone to waste. What would otherwise have been waste water power has been utilized at the peak of the load at the time when power is most valuable. The total output of the water power during the past year was over ninety per cent. of the possible output. When operating by steam, the engines have been run at an economical load, the advantages of the storage battery being nearly, if not quite, as great in connection with the operation of the steam plant as of the water plant.

The regulation of the system is much better with the battery than it could possibly be without it, and the service is much more reliable. The interlocking of the battery with the alternating current by means of the rotary transformers makes the battery act as a regulator on the alternating-current system as well as on the direct. During the daytime on Sundays the entire load, both direct and alternating, can be carried by the storage battery. The battery has frequently been allowed to feed the alternating system through the rotaries.

The transformer and battery station is operated by three men; the superintendent, an expert in the care of batteries, and two switchboard attendants. The labor in caring for a station of this output is a minimum.

The system could, of course, be operated with direct-current generators connected to alternating-current motors. This would necessitate in the place of each 250-

TOTAL LOAD ON ALL SYSTEMS



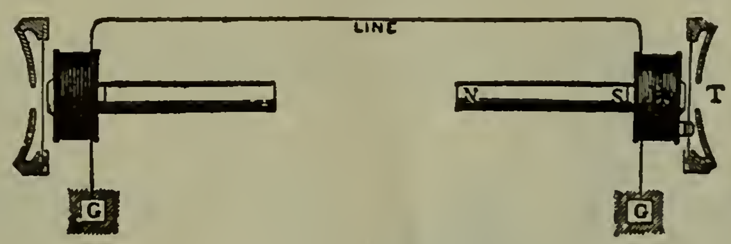
kilowatt transformer one 300-kilowatt motor direct-connected to two 125-kilowatt generators, and a smaller motor direct-connected to two boosters. The result would be a much greater investment in machinery, much greater floor space occupied, greater complication and expense of operation and a lower efficiency.

To sum the matter up, my Hartford experience has convinced me that the most satisfactory method of supplying electric energy over a considerable area is from a central power station generating alternating current; the current being distributed to rotary and battery sub-station of high voltage, and the energy locally distributed on the three-wire, direct-current system.

TECHNICAL NOTES.

BUILDING A SIMPLE TELEPHONE LINE.

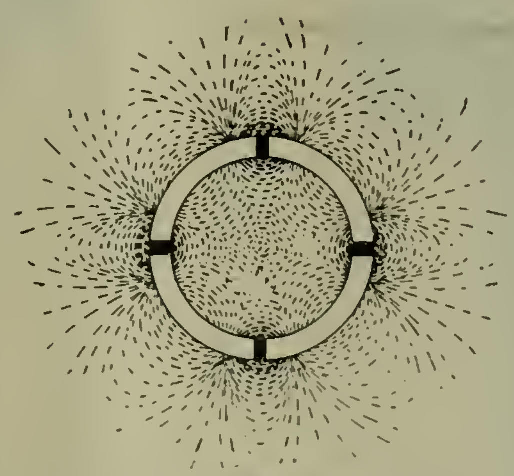
Many of our readers may be desirous of constructing a simple telephone line, one that is useful and inexpensive. The illustration fully explains how this may be done without any great difficulty. Two receivers are procured at some supply store and connected with one line, as shown. The other ends are connected to the ground. This is successfully done by carefully soldering them or winding them around a filed portion of the gas pipe. By this means the gas pipe system of a city serves as a return wire. For distances of a mile or less a little telephone of this kind is very practical and convenient.



Simple Telephone Line.

THE MAGNETIC CIRCUIT.

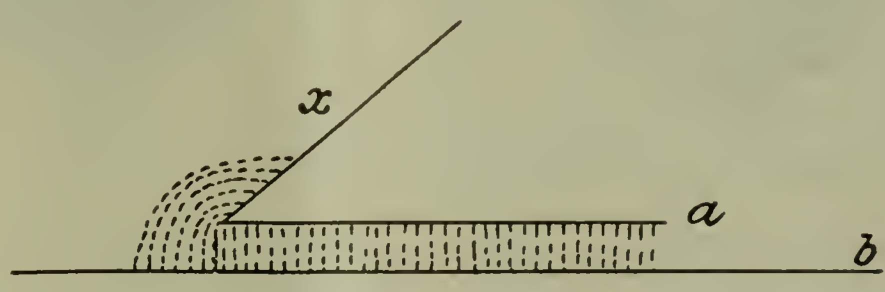
In the illustration is shown a magnetic circuit interrupted at four points by air gaps. At each of these points the lines of force spray out in so many directions that they form a comparatively intense field in the near neighborhood of the ring of magnetized metal. Leakage is also clearly indicated between adjacent segments by the spraying of the lines of force in the interior as well as the outside. In a machine with many poles this spraying tendency is apt to increase. It is likewise true that, as the size of the generator increases, the loss in magnetism in proportion becomes less. If this fact be clearly remembered by those who construct dynamos the reason why less power is consumed in proportion by the fields of large generators, other things being equal, is self-evident.



An Interrupted Magnetic Circuit.

LEAKAGE FROM POLE PIECES.

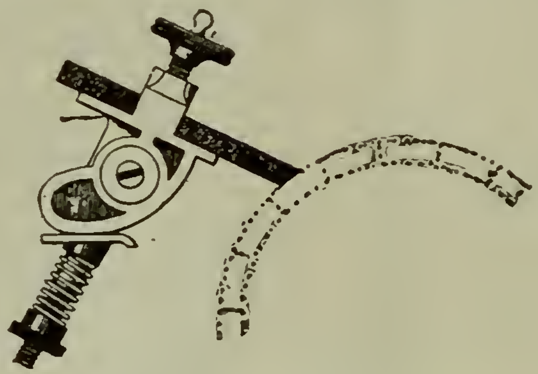
The recently deceased John Hopkinson was one of the first to pay special attention to the leakage from pole pieces. In his famous treatise on dynamo design found in the transactions of the Royal Association of London he shows that the air gap area is increased, due to the fact that the lines of force leak away from around the pole tips, thereby increasing the polar area. The illustration shows the leakage from X, the lines of force curving around, away from the pole tip to meet the surface of the armature. On account of this fact in designing dynamos the air gap should be calculated to be from 10 to 20 per cent. greater than it really is. In other respects leakage is not beneficial, it being considered a waste of magnetism, involving greater cross sections and consequently greater magneto-motive force than would otherwise be applied.



Leakage from Pole Tips.

THE ANGLE AT WHICH BRUSHES PRESS.

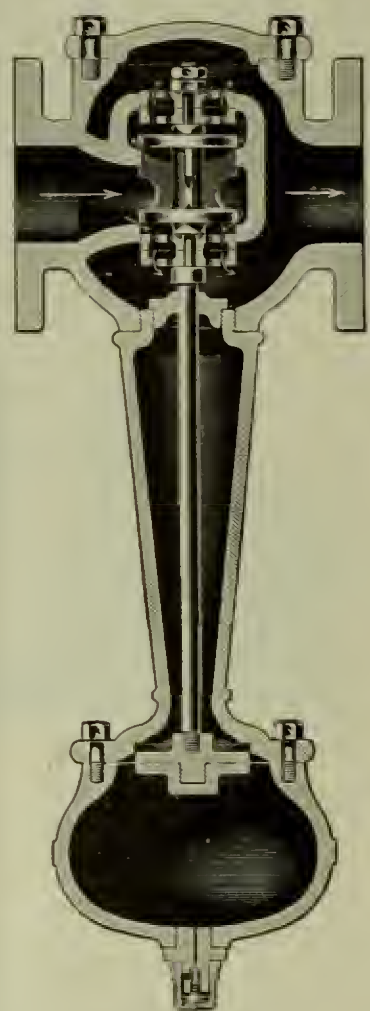
The angle at which brushes press is a matter of debate by many dynamo builders. The construction of the machine, the size and speed of its commutator should certainly influence the draughtsman and serve to assist in accommodating the angle of the brushes to the commutator. There was a time when a targent brush was thought to be the best, but at present in large generators the brushes press diametrically upon the commutator. When chattering results it is generally due to a lack of even contact between brush and commutator and insufficient lubrication, as well as an unsatisfactory angle of pressure. It is almost impossible to anticipate this angle, and the only true way in which it can be determined is by practically experimenting with the machine.



The Position of Brush on Commutator.

AIR SPRING PRESSURE REGULATOR.

The air spring pressure regulator for steam and air, as manufactured by the D'Este & Seeley Company, 29-33 Haverhill St., Boston, Mass., is a noiseless air spring pressure regulator in which the muffler principle is made use of. The purposes to which this pressure regulator may be applied express a variety as great as the wants of steam users for steam heating where high pressure is reduced to a constant low pressure, and in cotton, wool and paper mills its application is widespread. The valve is made noiseless by the substitution of an air spring instead of the cumbersome and comparatively inaccurate regulation by means of weights and levers or metal springs. The air itself forms a singularly elastic and perfect spring, fully supporting every part of the surface of the diaphragm on one side against the equal pressure on the other. As the valve, as shown in section view, is double seated, perfectly balanced and frictionless, it can be influenced by the slightest change in pressure and the sensitiveness of the air spring, governed by the dimensions of the air chamber. On electric light plants a uniform pressure may be secured even though the boiler pressure is uncertain. In fact, for this purpose alone the air spring pressure regulator fulfills a function of a most desirable and highly interesting nature.



Complete and Sectional View of Air Spring Pressure Regulator.

Nashville, Tenn.—The Whitsburg & Romeo Telephone Co. has been incorporated, with a capital stock of $900.

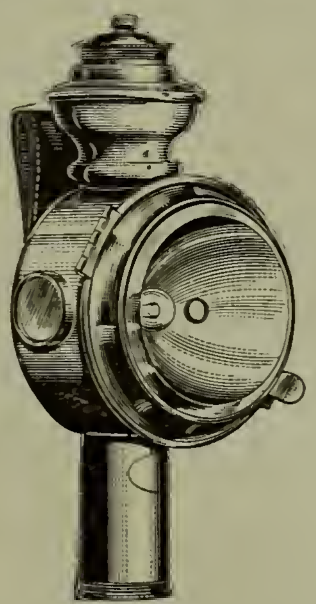
Edna, Tex.—A telephone line will probably be established at this place.

Macon, Ga.—A. Bisbee, of Savannah, and J. W. Rutherford, of Atlanta, are applying to the City Council of Macon for a telephone franchise.

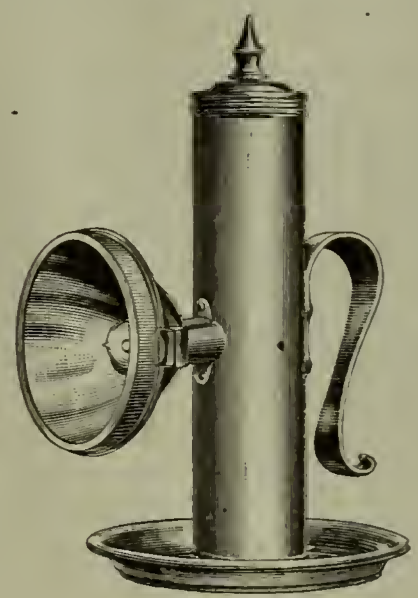
Anderson, Ky.—The Anderson Telephone Co. has been incorporated by J. J. Downey and others. Capital stock $12,000.

PORTABLE ELECTRIC LAMPS.

The U. S. B. bicycle lamp and various styles of other lamps made by the U. S. Battery Company, of 253 Broadway, New York City, are ingeniously constructed, light in weight and able to give the most perfect satisfaction to the user. The increasing demand for small lamps having clearness and power has brought into prominence the storage battery lamps shown here. The fact that they are clean, reliable and easily portable will make the reader conclude that the problem of bicycle lamp construction, and as far as it relates to other small lamps, is solved. A bright, strong light, such as given by the U. S. B. bicycle lamp, lays bare everything in the roadway fifty feet in advance of the bicyclist. The strongest wind may blow without affecting the uniformity of the light. It requires but a touch to put it on and a minimum of mechanical skill to recharge. The Friendly Beacon is a simple, convenient and invaluable aid in the house at night. Its use implies no stumbling around the room, injuring toes or other parts of one's person. The dangers of match striking and fires is entirely obviated. The dash lamp for light buggies and carriages of course combines features within itself which eliminates the use of oil, smoke and carbon deposits anywhere near the carriage. A steady and bright as well as a cheap one leaves



Dash Lamp.



The Friendly Beacon.

little to be desired. The additional convenience of being able to control it with a touch of the button forces one to pronounce the portable electric lamps, of which this is one, a necessary and inevitable part of the carriage, home and bicyclist's equipment.

AMONG THE SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The sixteenth general meeting of the Institute will be held at the Massachusetts Institute of Technology, Boston, on June 26th, 27th and 28th. The meeting of 1890 was held at the same place and was quite largely attended 540, or less than half the present number. The following papers are scheduled for presentation: Polyphase considering the membership at that time, which was only Electric Testing Methods, by Prof. H. J. Ryan; Symbolic Representation of General Alternating Waves, and of Double Frequency Vector Products, by Chas P. Steinmetz; Note on the Progress of the Closed Globe Arc Lamp, by Louis B. Marks; The Cost of Operation of Some Building Plants in New York City, by Percival R. Moses; Constant Current Transformers, by Prof. W. L. Robb; Notes on Recent Developments in Single Phase Induction Motors, by Chas. P. Steinmetz; Elements of n Favorable to Speed Regulation in Plants Driven by Water Power, by A. V. Garratt; Protection of Alternating Secondary Circuits, Dr. Cary T. Hutchinson; Air Gap and Core Distribution (part second), by Prof. W. E. Goldsborough; Electricity in Coal Mining, by Prof T. F. Jackson. Other papers suggested but not definitely settled upon may possibly be presented by A. D. Adams, S. E. Doane, E. A. Sperry and Prof. Laws. Among the objects of engineering interest which are likely to be visited are the Cambridge Pumping Station, the South Boston Electric Light Station, the Electric Plant of the Union Railway Station, the Atlantic Avenue Edison Station, the Central Power Station of the Boston Elevated Railroad, the West End Power Station at Cambridge, and the new Boston Fire Alarm Station.

NEW YORK ELECTRICAL SOCIETY.

The annual meeting of the New York Electrical Society for the election of officers took place at the Electrical Exhibition, Madison Square Garden, on the evening of Saturday, the 3d inst. The following members were elected: Frank Gordon Rice, Chas. B. McLeer, J. C. Forsyth, Edward A. Mahar, Jr., Ernest R. Bartlett, Chas. M. Crowfoot, A. M. Young, J. Arthur Holly, Joseph M. Cooper and Henri W. B. Blomquist. The report of the Secretary showed that 135 members were elected during the year, and the total number of members now on the books of the Society is 704. The average standard of the meetings has been appreciably raised, and the average attendance throughout the year has exceeded 200, thus breaking all the records of the Society. The Secretary does not recall any time when the Society has stood so high in public estimation, had a larger, steady accession of membership, and could point to a better record in a year's work than now. The report of the Treasurer showed that the Society is in better financial shape than it ever has been. A detailed statement of the receipts and disbursements for the past year will shortly be mailed to each member of the Society. The election of officers resulted as follows: President, Gano S. Dunn; vice-presidents, Dr. C. A. Doremus, Frank A. Pattison, Charles Blizard, Arthur Williams, F. V. Henshaw, Stephen L. Coles; secretary, George H. Guy; treasurer Henry A. Sinclair. After the business meeting Mr. W. J. Clark lectured to a crowded audience on "The future possibilities of wireless telegraphy."

Martin, Tenn.—Weakley County Telephone Co. has been incorporated by J. H. Nilsue, G. W. Hall, W. T. Lawler, G. E. Mowden, T. M. Ryan and others. Capital stock, $10,000.

MISCELLANEOUS.

STRAY CURRENTS.

ELECTRICAL INSURANCE.

A boiler insurance company in England has added the insurance of dynamos, motors, etc., to its other business. The plan is certainly a good one, as it secures the owner of an isolated plant, for example, a competent inspection at regular intervals and reimbursement in case of damages. Why should not this scheme be worth the attention of some of our American boiler insurance companies? —Ex.

MAKING POTTERY BY ELECTRICITY.

An electric process of pottery making, stated to have yielded remarkable results, has been developed by an English firm. The designs are produced by photography, and are burned in and covered with a special glaze in a special electric furnace, the perfect control of this form of furnace ensuring a product of the highest excellence.—Ex.

More Information—Tommy—Paw, what do they put water in stocks for?

Mr. Figg—To soak the investors with, my son.—Indianapolis Journal.

THE AUTOMOBILE AS AN AID TO SURGERY.

A new use has been found for the motor cab. A woman having broken her leg in the street, a motor cab and a doctor were telephoned for, and arrived simultaneously. The doctor brought an X-ray apparatus, and the cab brought the battery. The two being combined, an excellent skiagram of the lesion was obtained and suitable first aid rendered. The battery was then disconnected from the Rontgen tube, and by its means the cab took the woman to the hospital.—Ex.

Very Goodheart—Mrs. Von Tank is a great social light isn't she?

Ida Nownce—Well, rather! Regular Four Hundred scandal-power.

A NEW THERMOPILE.

A new thermopile has been devised which gives twice the electromotive force for equal differences of temperature that is yielded by platinum and platinum-rhodium elements. The elements of the new pile are platinum and an alloy of 90 per cent. of platinum and 10 per cent. of nickel, and are consequently cheaper than those of the platinum and rhodium battery.—Ex.

"How do you manage to find your way across the ocean?" said a lady to the sea captain.

"Why, by the compass. The needle always points to the North."

"Yes, I know. But what if you wish to go South."

APPLICATION OF WIRELESS TELEGRAPHY TO NAVIGATION.

Mr. W. J. Clarke has suggested a means of detecting the presence of a ship or an iceberg by wireless telegraphy. The apparatus which he proposes is so arranged that when two ships approach each other a large vibrating gong will ring in each, and the transmitter is so arranged that the signal would be operated at a distance of from one to ten miles. Mr. Clarke claims that if it were made compulsory that sea-going vessels should be so equipped with the necessary outfit, it could be carried out at a small cost. —Journal of the Franklin Institute.

The New York "World," commenting on Herr Pollock's improvement in telegraphy, by which he claims to be able to transmit 60,000 words per hour over one wire, says: "It will be chiefly important to the society reporter, who will now be able to give a verbatim report of an afternoon tea."

ELECTRIC LIGHT BATHS.

Electric light baths, or systematic exposures of the body to the rays of arc lamps, seem to have become an established therapeutic agent in Germany. Their principle is that of ordinary sun baths, but advantages are claimed in the facts that the electric light is at all times available that it can be regulated, according to the strength of the patient and to the disease, that the action upon the heart is very slight, and that harmful bacteria in the body are destroyed rapidly. The baths are administered in a mirror-lined box, in which the disrobed patient is seated with his head projecting outside through a hole in the lid. The sensation experienced is an agreeable and gradually increasing heat, inducing the profuse sweating of the Turkish bath, and complete cure or material benefit is reported in rheumatism, gout, Bright's disease, asthma, chronic catarrhs, skin diseases, and nervousness.—Ex.

ELECTRIC CANAL-TOWAGE IN GERMANY.

The "Elektrotechnische Zeitschrift" conveys the information that the firm of Siemens & Halske is at present engaged in constructing an experimental electrical outfit for a trial of the method on a section of one of the German canals. The plant consists of a power station from which current is supplied through an overhead conductor to electric locomotives, which run upon a narrow-gauge railway laid along the canal bank. The canal boats, in this case, will simply be towed—a number in each tow—by the engine. In experiments on electric canal-haulage made in this country several years ago on the Erie canal, it was proposed to run an overhead conductor along the canal line, and to equip the boats with electric motors, taking current for actuating their propellers from the line by the usual form of trolley. This, it will be observed, is substantially different from the German plan above described.—Journal of the Franklin Institute.

A MAGNETIC ISLAND IN THE BALTIC SEA.

Bornholm, a Danish possession in the Baltic, is a good example of a magnetic island. This island is famous for its geological peculiarities; it consists almost entirely of magnetite, and its magnetic influence is not only very well known to the navigators of those waters, but also much feared by them, on account of its influence on the magnetic needles, which makes the correct steering of a ship a matter of much difficulty. In fact, this influence is felt even at a distance of miles, and so palpably that, on the island being sighted by the mariners on the Baltic, they at once discontinue steering their course by the needle, and turn, instead, to the well-known lighthouses, and other signs to direct their craft. Between Bornholm and the mainland there is also a bank of rock, under water, which is very dangerous to navigation, because it is constantly submerged, vessels having been frequently wrecked at that point. The peculiar fact in this case is that the magnetic influence of this ore bank is so powerful that a magnetic needle suspended freely in a boat over the bank will point down, and if not disturbed, will remain in a perfectly perpendicular line.—Ex.

IMPROVEMENT IN THE ART OF SEPARATING METALS ELECTRICALLY.

Tomassi, an Italian expert, has proposed a mechanical improvement in the operation of the electrolytic bath used for the extraction, separation and refining of metals, which may prove to be of practical value. The aim of the inventor is to reduce the resistance in the electrolytic cell, and thereby reduce the cost. His electrolyzer consists of a rectangular tank in which are placed two anodes between which is placed a circular metallic disc mounted on a gun-metal spindle, and capable of being rotated. The disc is partly out and partly in the bath.

and so comes in contact with the air and the electrolyte. The part of the disc outside the electrolyte comes in contact with two scrapers, one on each side, which scrape off the spongy deposit and depolarize the surface. The anodes are either in the form of plates, or in receptacles containing coarse powder. When the cathode has a sufficiently thick layer of metal it is taken to a bath of molten metal similar to that deposited, and the electrolytic deposit is melted in the bath, and then the cathode is taken back to the electrolyzer. Mr. Tomassi claims that polarization is entirely done away with, that the metal deposited is removed as the deposition proceeds, and that the density of the liquids in all parts is the same.—Ex.

ALUMINUM FOR TRANSMISSION CIRCUITS.

The adaptability of aluminum as a conductor for electric currents is exciting more and more interest as the price of aluminum is lowered on account of improvements in the methods of its production. The following table gives some interesting figures regarding the relative merits of aluminum and copper, the latter metal being now used almost exclusively in transmission work:

	Aluminum.	Copper.
Resistance, for equal sizes	1.8	1
Weight, for equal sizes	.3	1
Weight, for equal length and resistance	.48	1
Price per pound at 29 and 16 cents, bare line wire	1.81	1
Price for equivalent resistance, bare line wire	.868	1
Temperature coefficient	0.002138	0.002155
Breaking strength, for equal sizes, about	1	1

Copper has a decided advantage in regard to resistance for equal sizes, but aluminum has a great advantage in the matter of weight, an aluminum wire being less than one-third as heavy as a copper wire of the same size. An aluminum wire possesses less than one-half the weight of a copper wire having the same length and resistance, although of course in this case the aluminum wire would be considerably larger than the copper wire. Pound for pound, aluminum at the prevailing prices is almost twice as expensive as copper, but for two wires of equal resistance and length the aluminum will be over 13 per cent. cheaper than the copper wire. For equal sizes the strength of aluminum and copper wires will be about equal, but for equal resistances the aluminum wire will have a considerable advantage in the point of strength, as well as of cost.

Both alumninum and copper are practically indestructible under ordinary atmospheric exposure, and there would probably be but little choice between them in this regard. The fact, however, that a given current-carrying capacity can be obtained with a smaller wire of copper than of aluminum will probably prevent aluminum from ever displacing copper to any great extent in the windings of electrical machinery and apparatus. In fact, wherever room is to be economized, copper has a distinct advantage over aluminum, and will probably therefore be used in most cases. On transmission lines, however, except those using cables, the fact that aluminum is somewhat more bulky for a given resistance, would be of little disadvantage from a mechanical standpoin, except for its resistance to the wind, while it would possess an advantage in regard to strength, cost and weight. From an electrical standpoint, however, there is one disadvantage, due to the greater size of an aluminum wire which is usually overlooked by those viewing the situation superficially. Its greater surface for a given conductivity renders its electrostatic capacity with respect to the earth or with respect to other conductors much higher; and, as high electrostatic capacity is a feature to be avoided in many cases, this objection is a rather serious one, and will undoubtedly prohibit the use of aluminum in some installations. This is particularly true of telephone circuits, in which distributed electrostatic capacity is the greatest bugbear encountered.—Steam Electric Magazine.

BUSINESS NEWS

THE MONTAUK MULTIPHASE CABLE.

The Montauk Automatic Thermostatic Fire Detective Cable covers a field which heretofore, electrically speaking, has been but tentatively occupied. Anything that has true intrinsic merit must grow despite all difficulties encountered. The cable requires no exterior aids; the fact that it accomplishes certain results, and that it is based on a natural law, renders it independent of exterior support such as is usually sought for by devices intended to accomplish, in a measure, like results. It is because of these features that the installations of this cable are rapidly multiplying. Messrs. Stanley & Patterson, of New York, a firm well known to the electrical trade, and jobbers in this cable, among other installations, have recently placed an equipment in the home of Mr. Joseph Pulitzer, of the New York "World"; the firm of Doscher & Hartwell, electrical contractors, among other installations, have recently equipped the Winter residence of Mr. George Taylor, in New York City, and also his Summer residence on Long Island; the Jenney Construction Company, Havemeyer Building, are doing a prosperous business in the installation of this cable, and among the many installations made by them may be mentioned the Winter and Summer residences of Mr. A. A. Cowles, president of the Ansonia Brass & Copper Company. Among the various installations made by the Gamewell Auxiliary Fire Alarm Company, the Dundee Chemical Works, Passaic, N. J., and the Jessup & Moore Paper Mills, Wilmington, Del., may be cited.

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR THE WEEK ENDING MAY 30TH, 1899, $63,194.

New York, May 30, 1899.—The following exports of electrical material, electrical machinery, etc., are from the port of New York, for the week ending this date:

Argentine Republic—Seventeen packages electrical machinery, $1,217; 211 packages electrical material, $11,033.

Bremen—One case electros, $30; 11 cases electrical material, $500.

British West Indies—Twenty-six packages electrical material, $326; 15 cases electrical machinery, $527.

Berlin—Seven packages electrical material, $1,459.

British Australia—Eighty-two packages electrical material, $3,288; 1 case electro plates, $20.

Charkow—Thirteen packages electrical material, $263.

Chili—Eighteen cases electrical material, $553; 5 cases electros, $694; 16 cases electrical material, $523.

Cuba—Three cases electrical material, $68.

Central America—Three cases electric motor, $197.

Dublin—Forty-four packages electrical machinery, $15,186.

Glasgow—Four cases electrical machinery, $830.

Hamburg—Ninety-eight cases electrical material, $8,645.

Havre—Thirty-seven packages electrical machinery, $8,121; 23 cases electrical material, $662.

Liverpool—Two cases electrical material, $250.

London—Fourteen boxes electric motors, $700; 52 packages electrical material, $3,908; 44 cases electrical material, $405.

Marseilles—Four cases electrical material, $99.

Mexico—Sixteen cases electrical material, $1,081.

Newfoundland—Nine packages electrical material, $241.

Porto Rico—Eighteen packages electrical material, $273.

Southampton—Three cases electrical machinery, $450.

Santo Domingo—Fourteen packages electrical material, $387.

Tasmania—Twenty-five cases electrical material, $1,141.

U. S. of Colombia—Three packages electrical material, $78.

Venezuela—Two cases electrical material, $39.

NEW INCORPORATIONS.

Dover, Dela.—Speer Carbon Co. has been incorporated by Andrew Kaul, J. S. Speer, Louis Strepoer and Burr E. Cartwright; manufacturing electrical machinery and supplies.

Utica, N. Y.—Trenton Falls Electric Light & Power Co. has been incorporated by M. J. Brayton, H. M. Scheuch, and H. B. Sweet; electric lighting, etc. Capital stock $55,000.

Jersey City, N. J.—Caracas Construction Co. has been incorporated by John C. Tomlinson, Rafael R. Govin, and N. T. M. Melliss; erect works to supply electricity for light, etc. Capital stock $1,750,000.

Camden, N. J.—York Light, Heat & Power Co. has been incorporated by Charles C. Frick, Frank R. Hansell, and John H. Cromie, Jr., to carry on the business of a light, heat and power company. Capital stock $350,000.

Chicago, Ill.—Dearborn Power Co. has been incorporated by H. Holmes, C. F. Hart, and J. K. Green; distribution of electric light, heat and power. Capital stock $25,000

Wheeling, W. Va.—Belmont Electric Light & Power Co. has been incorporated by J. Clements, C. Rosser, L. F. Gerrish, J. T. Flynn, and T. E. Shelley. Capital stock $100,000

Kankakee, Ill.—Kankakee Water Supply Co. has been incorporated by D. H. Paddock, B. L. Cooper, and J. P. Borrisard; operating electric light plants, etc. Capital stock $40,000.

El Paso, Tex.—The International Light & Power Co. has been incorporated by A. Krakauer and others; to erect an electric light plant.

Portsmouth, Va.—Portsmouth Electric & Gas Co. has been incorporated by W. T. Reed, G. Hatton, J. L. Biliosly, R. E. Cramp, J. T. King, and Charles O. Haines. Capital stock $50,000

Atlantic City, N. J.—Pennsylvania Gas Fixture Co. has been incorporated by Ernest N. Rupp, Morris Ariensberg, John Aganian, and Frederic A. Chapman; to manufacture gas and electric fixtures. Capital stock $100,000.

Wilkesbarre, Pa.—Economic Electric Co. has been incorporated by A. F. Derr, E. A. Phelps, J. E. Sayre, F. E. Parkhurst and E. H. Dairs; supply light, heat and power. Capital stock, $75,000.

TELEPHONE CALLS.

Eveleth, Minn.—Mesaba Telephone Co. has been incorporated by C. W. More, F. C. Talboys, O. D. Kinney, G. W. Buck and W. Harrison. Capital stock, $25,000.

Houston, Tex.—Citizens Telephone Co. has been incorporated by A. L. Waterbury, E. A. Glass, F. C. Bogart, W. G. Sears and W. Bucklin, Jr., to operate a telephone system in Houston. Capital stock, $100,000.

Rural Retreat, Va.—Rural Retreat Telephone Co. has been incorporated by J. M. Phipps, C. W. Davis, E. M. Davis, J. W. Eiffert and C. C. Catron; general telephone business. Capital stock, $5,000.

Whitesburg, Tenn.—Whitesburg & Romo Telephone Co. has been incorporated by B. C. Wiesner, T. S. Myers, S. Rodes, W J. King and S. W. Myers. Capital stock, $900

Athens, Tenn.—Athens Telephone Co. has been incorporated by T. J. Long, G. Crow, L. W. Rose, J. L. Long. Capital stock, $10,000.

Dresden, Tenn.—The Weakeley County Telephone Co. has been incorporated, with a capital stock of $10,000.

POSSIBLE INSTALLATIONS.

Jennings, La.—P. M. Kokanour, Mayor, may be addressed concerning the erection of electric light plant.

Carthage, Mo.—G. Jaeger has received contract for erection of proposed electric light plant at Carthage.

St. Louis, Mo.—The Imperial Electric Light, Heat & Power Co. is making extensive enlargements to its plant.

Maxton, N. C.—The Maxton Light & Power Co. will construct an electric light plant.

Manning, S. C.—The Mayor may be addressed concerning contemplated erection of electric light plant.

Chattanooga, Tenn.—Efforts are being made for the establishment of an electric power plant.

BUSINESS CHANGES.

Forest City, Ark.—St. Francis Electric Light Co. has increased its capital stock to $12,000.

THE FERRACUTE MACHINE CO., of Bridgeton, N. J., U. S. A., manufacturers of presses, dies and other machinery for sheet-metal work, have recently published a new catalogue, 12, which is neat, complete and very interesting. They have for several years paid particular attention to presses and dies for making armature disks and other electrical work and have been successful in introducing its machines into the largest factories. They are at the present time building some of the largest sizes of these presses to send to Belgium and South Africa, as well as some for the United States, and will be glad to send their catalogue to those interested.

The Electrical Age.

VOL. XXIII—NO. 24 NEW YORK, JUNE 17, 1899 WHOLE NO. 631

ELECTRIC LIGHTING.

Fig. 4.

Fig. 3.

THE ARC LAMP DEPARTMENT OF THE CENTRAL STATION BUSINESS.

(By H. W. Hillman).

There is no one branch of greater importance to the Central Station business to-day, than the Arc Lamp Department. While many of the larger Central Stations have realized the need for such a department and appreciated its importance, the majority of the Electric Lighting Companies throughout the country have not as yet given this subject the attention it deserves.

To create, and maintain, a successful Arc Lamp Department, one of the most essential requirements is to secure the services of some bright, active, solicitor, well posted on the subject of modern arc lamps, the cost of operating, arguments in their favor, as well as against other forms of artificial light. Often the Lighting Company, has some energetic man either in its office or station, who can be educated to take up this work to the advantage of the Company, and great assistance to the central station manager. In other cases the managers are able to devote considerable personal attention to the matter of soliciting. There are many Lighting Companies, however, which are suffering in this respect, for the reason that the manager is not only too busy to devote much time to the arc lamp business, but has not as yet considered it sufficiently important to place a man on this particular work.

Some of the prominent subjects with which the solicitor should be familiar, in order to make a good showing for the Arc Lamp Department, are as follows:—

The relation of the Central Station to the merchant.

Adaptability of Electric Arcs to store illumination.

Familiarity with modern methods of illumination. Also candle power ratings.

Importance of careful installation.
Specialities in arc lighting; low current, lamps, etc.
Thorough knowledge of arguments against Welsbach burners.
Maintenance expenses, quality of light, and cleaning of inner globes.

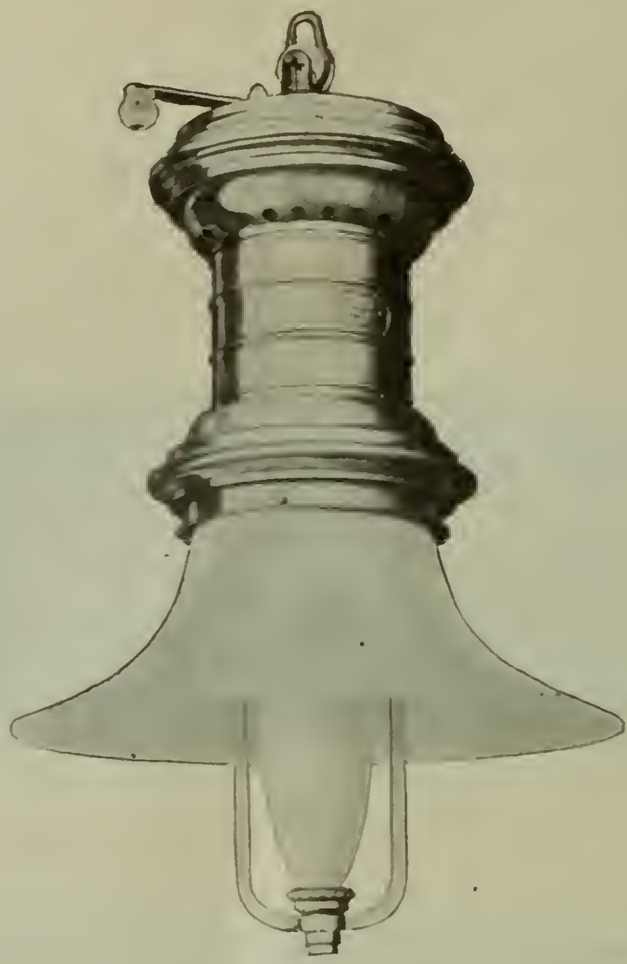


Fig. 1.

Fig. 2.

Opportunities are afforded for skillful arrangement in the matter of installation. Cut No. 1, the single globe style of lamp is most popular for many classes of business, whereas the double globe type, can be highly recommended for certain work especially in the display of materials exhibited among the various departments in dry-goods stores. Merchants will highly appreciate the extra time spent by the solicitor in studying his requirements for light, and the earnest effort put forth, to furnish the most modern, and up-to-date, lamps known to the trade. Let the Lighting Companies, all over the country advertise these points, for they are strong arguments.

The lighting industry of the world, has been revolutionized, and the arc lamp department has now become one of the most prosperous branches of the Central Station business.

Merchants frequently ask, "What is the candle-power of your lamp?" and are greatly confused upon being advised that it is 1,200 or 2,000 candle; in fact, the solicitor, and station manager likewise meet with considerable difficulty when touching upon this subject. Reference to a 1,200, or 2,000 candle-power rating, means but very little to a merchant. A much easier, clearer, and more satisfactory method, is to refer to the number of square ft. of surface which can be satisfactorily lighted, by each arc lamp. As an illustration, cut No. 2, shows a room containing 2,800 square ft. well lighted by 4 alternating, 6 ampere lamps, each lamp lighting an area of 700 square ft. The lamps are suspended 8 ft. from the floor.

ARGUMENTS AGAINST WELSBACH BURNERS.

Where competition is keen, the price of gas low, and a good solicitor employed by the gas company, it requires energetic work, and effective arguments, to increase the number of arcs in service or even to hold business, already secured. One very good way of creating a stir in the matter of lighting is to equip the windows of some representative store with a first class arrangement of lighting, installing the arc lamp, so that the source of light is not shown, but that the material on exhibit is displayed to perfection. (cut no. 3.) Then select some window lighted by Welsbachs, for comparison, (cut no. 4.) The argument seems conclusive that a merchant having considered it sufficiently important to light his windows for evening advertisement, can well afford to have the best light obtainable.

The photographs were taken by the artificial light from the lamps at nine o'clock in the evening, each having had the same time exposure. By introducing lamps in the tention of the store proprietor that infrequently, it is an entering wedge toward displacing gas throughout the entire store; especially is this true where colors have been accurately matched beneath the rays of the electric arc. There are many arguments against the use of Welsbachs for commercial work, which are within easy access of solicitors earnestly anxious to learn all their weak points. One of the most annoying and dangerous, as well as expensive features, seems to be that of "burning off the wax" from the new mantels. Coupled with the use of matches for igniting the gas, and compared with the enclosed arc, so conveniently lighted, there would appear to be no reason why Welsbachs should be used for commercial lighting.

It may be interesting to note that 100 Direct Current Lamps, operating an average of only 4 hours daily, afford a gross annual income of $7,920 at a rate of 12 cents per kilowatt hour. Considerable experience and investigation on this point of increased business shows that about 200 commercial arcs can be introduced in cities as large as 20,000 to 30,000 population, favored with 2 or possibly 3 dry goods stores. In other words, a business is created of approximately $16,000 annually, offering satisfaction to merchants, and driving out of commercial use from 800 front of the store, the light is called so forcibly to the at- to 1,000 Welsbach Burners. I have not attempted to couple with this proposition the benefits to the Incandescent, Power and Fan Motor branches of your business, which if figured out on the same basis, would demonstrate that while the same percentage of profit cannot be reasonably expected after reducing rates, yet a lower percentage figured on an increased gross amount will produce equal, if not increased, profits in dollars and cents.

As to the best combination of globes, a clear inner and clear outer, produces a very good lighting effect, but an opal inner, instead of a clear, is highly recommended. With this combination the volume of light does not seem to be cut off sufficiently to be noticed, even by a keen observer, yet it does away entirely with the violet color of the arc, furnishing a beautiful illumination, free from shadows, and desirable in all respects.

No hood is required with this modern street lamp, and this feature above all others, contributes to its attractive appearance. With the several thousands of lamps now installed in various parts of the country, the most favorable comments are freely made in regard to the attractive appearance of the entire installation.

The policy outlined above, if pursued in a careful manner, by a Central Station Manager, will tend to get away from further reference in future contracts, to the candle-power rating of an arc lamp. As an illustration, I would cite an actual case where a contract was recently made between a city and an Electric Lighting Company, in the West. The $7\frac{1}{2}$ ampere alternating enclosed arc lamp was suspended at a point in the main business street of the city, and located between two old style 9.6 ampere series open arc lamps. Opportunity was afforded all parties interested to make comparison of the light distribution, with the result that the contract subsequently entered into called for lamps designated as the $7\frac{1}{2}$ ampere alternating enclosed arc lamp. No reference whatever was made to candle-power rating.

While the tendency among the cities and towns is gradually in the direction of securing a lower price per lamp per year when renewing the street lighting contract, yet the remrkable increase in the last few years in the amount of light used for interior lighting, should encourage a liberal extension in the number of lamps required for street service. To educate the city rather along these lines, and to consummate a plan substantially on this basis, will preserve the electric lighting business, and offer bright prospects for Central Stations, approaching the time when another contract must be made with the city government.

TELEGRAPHING WITHOUT WIRES.

THE EXPERIMENTS OF PROF. HUGHES ON ETHER TELEGRAPHY.

*(By J. Munro.)

Prof. Hughes was kind enough to show me his original experiments on ether telegraphy whilst he was at work on them, but although I suggested their publication he declined to sanction it. Now that Mr. Fahie has drawn the secret in a letter from him, I am able, by his courtesy, to write the following account of them:

In 1877, as we already know, Prof. Hughes, confined to his rooms with a cold, began the experiments which led to the invention of the microphone. He seems to owe that chill the better part of his renown; for it introduced him to a series of discoveries which hung together. In working with the microphone he was troubled by induction, and devised not only a method of annulling it on telephone lines, but the induction balance and sonometer. A still more valuable prize was lurking in this corner of research, like a nugget of gold in the sand of the prospector, and had he been careless or unskilled he might have missed it, as many miss their luck, for want of eyes to see.

When at work on his induction balance, a battery and interrupter in the primary, and a telephone in the secondary circuit, he was troubled sometimes with a noise in the telephone, and could not get a balance. The source of the evil was a loose joint in the wire of the secondary circuit, and on substituting a mocrophone for it he found a similar disturbance in the telephone. Apparently the ef-

*London "Electrical Review."

fect was not caused by the induction of the primary on the secondary coils, which he could suppress by adjustment, but was directly due to the "extra spark" produced at the interrupter in making and breaking the current.

The prenomenon was new to him, and he began to investigate it, with his usual self-made apparatus of the simplest kind—sewing needles, bits of cork, wood, and carbon, odds and ends of wire, pomade bottle, penny boxes, purchased at a dentist's, and presumably for holding false teeth, not forgetting, of course, the indispensable red sealing wax to stick the parts together I am afraid that a dealer in old curiosities would scarcely give the entire collection house room.

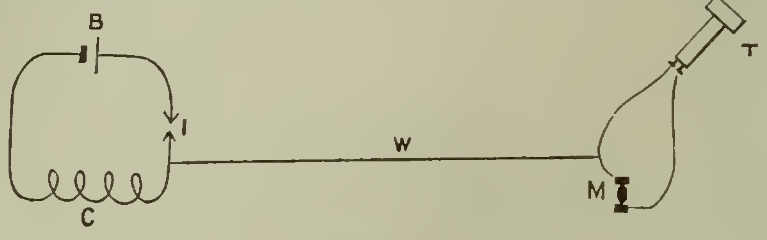


FIG. 1.

The infinite pains Prof. Hughes must have taken are well shown by what remains of these instruments and the square black note books filled with numerous experiments in ink or pencil, dated or dateless, some of them marked "extraordinary" or "important." The most interesting or fruitful of them run from October to the end of 1879, but he did not quite abandon the subject until 1886.

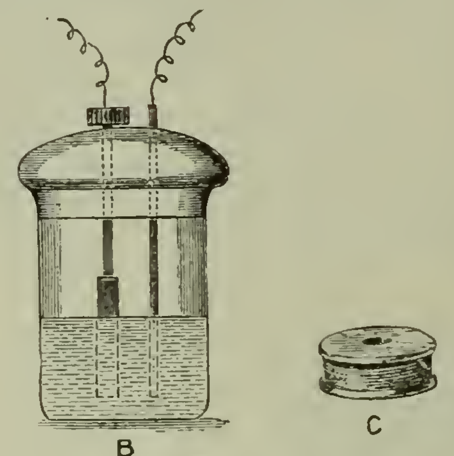


FIG. 2.

At the outset he joined a single cell, B (fig. 1), in circuit with a clockwork interrupter, I, and a primary coil, C, from the induction balance. This "transmitter" was connected by a wire, W, several feet in length to the "receiver," a telephone, T, in circuit with a microphone, M, and the "extra spark" of the interrupter was distinctly heard in the telephone.

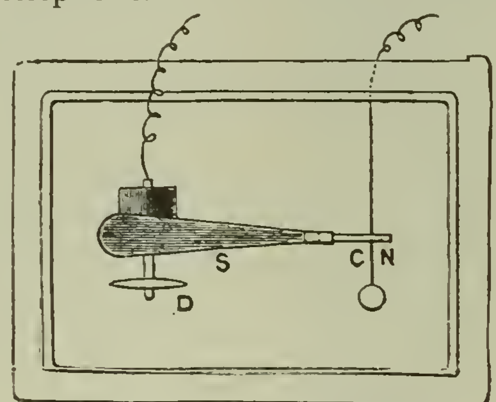


FIG. 3.

The battery, B, (fig. 2), a simple acid cell in a pomade bottle, and the small mahogany bobbin, C, about two inches in diameter, wound with copper wire, covered with green silk, produced no visible spark when the current was broken, but strange to say it seemed to charge the whole atmosphere and walls of the room for the moment. With a battery of six cells the effect was so strong as to damage the insulation of the coil.

The noise in the telephone was influenced by the nature of the extra spark. With an electromotive force of 1-50 volt it was better than with several cells. It was louder and clearer when the contacts of the interrupter were of metal to metal, not metal to carbon or carbon to carbon. Again, an iron core in the coil, thought it gave a stronger spark, did not improve the sound, but on the contrary. Indeed, the spark from the Faraday electromagnet of the Royal Institution excited by a large rove battery ,had little effect on the microphone and telephone. Even a dynamo at work beside the receiver gave a very poor result.

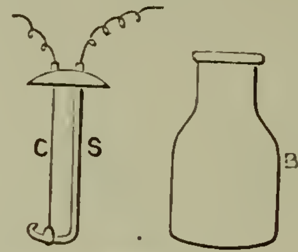
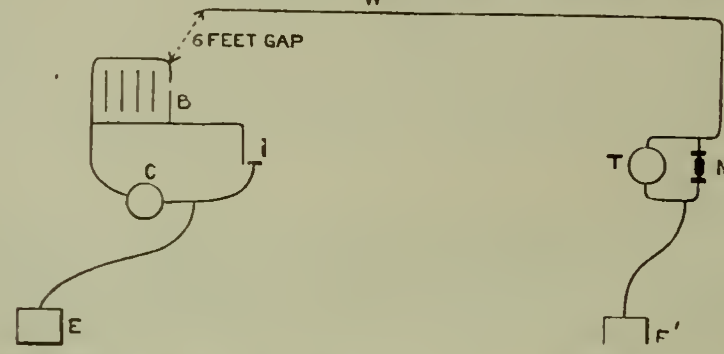


FIG. 4.

The Tiny spark from a stick of sealing wax rubbed on the sleeve was more effective than the discharge from a big Leyden jar, but a spark was requisite, for the jar, heavily charged and simply held near the microphone, did not seem to influence the telephone.

The Professor concluded that a small, thin, quick spark was better for the purpose than a large, thick, slow, or "fat" spark, to use his own term. A short, sudden, rather than a long, gradual change of potential is desirable, and hence it does not follow that increasing the size of sparks will improve the efficiency of the "wireless telegraph." Moreover ,the sinuous currents necessary to transmit speech are unsuited for the microphone "coherer," and a "wireless telephone" cannot be expected unless a different method is found out.



First room. Second room.

W, Wire; B, Battery; I, Interrupter; C, Coil; E, Earth (gas pipe); T, Telephone; M, Microphone; E', Earth.

Prof. Hughes tried many experiments to satisfy himself that his receiver, in other words, his microprone and telephone, was influenced by the extra spark and not by the ordinary electro-dynamic induction. He inserted coils in the transmitting and receiving circuits, placing them parallel and at right angles to each other, that is to say, in positions favorable and unfavorable to induction,but without modifying the effect. He also reduced the number of turns on the coil, C, (fig. 1), and even eliminated it altogether, but when the battery and interrupter were only connected by three inches of wire, and the microphone to the telephone by as little, he still heard the sounds of the "make" and "break." That electrostatic induction did not count, was tried by inserting charged inductors of

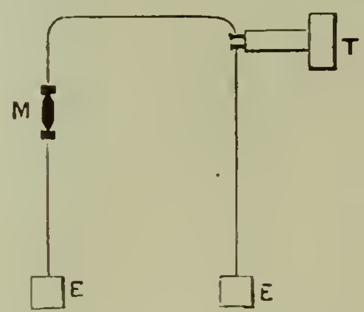


FIG 6.

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CONTENTS

THE ELECTRIC BOAT.

Although considerable attention has been paid to the construction of electric boats in this country the subject is one of deeper interest to England, Germany and France from a commercial standpoint, than to ourselves. In Hamburg, although it cannot be said that electric boats predominate, a great number of small vessels using kerosene are constantly plying back and forth along the water front and up and down the river Elbe. They are used for all sorts of purposes, the least of all, apparently, being that of pleasure. It would of course seem natural for a land like Holland to use a vast number of these little boats, but by some strange perversity in human nature the land of dykes and ditches, of canals and waterways, lets them go by the board.

In England and France electric boats have received such careful consideration that there, if anywhere, they have reached a state of comparative perfection. Vessels thirty-five, forty and fifty feet long have been built, equipped with storage battery and motor and used for trips of quite some length. The river Thames is provided with electric stations at certain points along its banks to which the launches may attach themselves and be recharged with power. The same is true of the river Seine in France, which offers exceptional opportunities for such purposes.

Although the art of boat building is old, electric launch construction in this country has not made the progress that should be expected of it. From an economical standpoint it seems likely that the propulsion of large steamers by electric power cannot be as satisfactory as the use of steam. The reason is obvious. On board ship of any size or consequence engines are employed of the very highest efficiency, better engines, in fact, than would be used to drive dynamos on shore; the cost of coal for power is therefore reduced to a minimum. The efficiency of the triple or quadruple expansion engines of an ocean liner may therefore exceed fourteen per cent. An engine and dynamo on land would only be capable of producing ninety or ninety-fie per cent. of this in the form of electricity, and when the power is stored in accumulators from twenty to thirty per cent. would be lost. Connecting the motor on to the batteries would involve a loss of another ten per cent., so that the best possible return on the average would be fifty per cent. of the indicated horse-power of the engine which would mean a general efficiency of less than eight per cent. as compared with that of fourteen per cent.

The conclusion to be reached by this preliminary survey of the circumstances is that one hundred thousand horse-power to be used on board a large yacht would necessitate the storing in accumulators of two hundred horse-power to provide against emergencies such as bad weather, delays, injured cells, etc. The cost of transporting potential energy in the shape of coal, as compared with the cost of transporting it in the shape of storage batteries, may show a difference as great as ten to one. Such a comparison would call for a consideration of the cost of coal added to the cost of the machinery utilizing it, that is to say, the boilers, pumps, condensers, etc. In spite of all this, even though storage batteries were economical to use on ocean liners for power propulsion, what would be done in mid-ocean if a short circuit took place or the weather was stormy and spilled the contents of the cells? Such questions as these would put a quietus on those who think that electricity, like some of our successful pugilists, could do everything.

As far as the electric boat is concerned, whereas it has been a success from a practical standpoint, it is not known to be such by the general public, mainly on account of the lack of facility for caring for it. If certain piers on the East river, Battery, Harlem and North river, could supply electric power and make a specialty of supplying it to electric launches their advantages, cleanliness and convenience would be clearly demonstrated. In all probability they would become extremely popular, finding no rivals to equal them in the discharge of their functions. All the room on such a vessel can be utilized, the batteries being under the seats and the motor under the flooring. With no risks of explosion or fire the lovers of this craft would soon realize an ideal.

The power of Niagara has been estimated at about seven million horse-power. Greater, probably, than the physical force the whole human race is capable of continuously exerting. At present about three hundred and fifty thousand horse-power is to be developed on the American and Canadian sides or about five per cent. of the total power available—not enough to perceptibly diminish the flow over the Falls. However, should the whole be utilized, leaving the rocky river bed dry and bare, we would but be substituting a wonderful cataract of etheric energy for the splendid flow of gravitational matter so just ly famed. Which spectacle would present greater beauty would depend on the individual.

To those who trace in imagination the course of a beam of sunlight as it buries itself in the ocean, rises in cloud and falls again in grateful shower over grainfield and vineyard, filling brook and swelling river, and finally tumbling through mighty turbines and silently streaming from the polished slip rings of stately dynamos, bursting again to the wholesome sunlight to brighten the homes of hundreds, the substitution would but be the completion of a full cycle of usefulness and beauty.—Prof. R. B. Owens, in "Cassier's Magazine."

surface, for example, metal discs in the circuits, and shifting their positions with respect to each other. Apparently the influence might be described as conduction rather than induction. In short, it was evident that the extra spark of the interrupter was able to charge the whole surrounding space. It appeared to radiate electrical impulses or waves in all directions as a burning spark radiates light or heat, and these electrical rays impinging on the microphone produced a momentary current in it which caused a sound in the telephone.

Some imagined that heat produced the ordinary action of the microphone, and Prof. Hughes in seeking to explain the new effect supposed that the electric waves excited a thermo-electric current in it, and the fact that heating the contacts or making them of different materials enhanced the effect, is, perhaps, favorable to the view. If I may speak for myself, however, I regard the true cause of the action as a mystery at present. We may not understand it until we know what electricity is, but on the other hand, it may help us to that knowledge. Seemingly, the action of the receiving telephones of the Elisha Gray and Edison, in which a finger rubs on a metal plate, and a style on a chalk cylinder are also due to it. On suggesting to Prof. Hughes, however, that electric waves might influence the chalf receiver as they do a microphone, and cause it to act, he thought the effect, if any would be feeble.

Of course, it was highly important to find the most sensitive form of microphone to receive the rays, as we may call them. Contacts of metal are apt to "cohere" or stick together, apparently by the electrical waves welding them. A microphone which is both sensitive and self-restoring, that is to say, does not cohere, is made with a carbon contact resting lightly on bright steel. Such a receiver is shown in figure 3.
where C is a carbon pencil touching a needle, N, and S an adjustable spring of brass by which the pressure of the contact can be regulated with the disc, D. An extremely sesitive, but easily deranged form of microphone is represented in fig. 4, where S. is a steel hook, and C is a fine copper wire with a loop on the end which has been oxydized and smoked in a flame. The carbonized loop and steel contact are inserted into a small bottle, B, for safety. Another form of microphone which the professor tried was a tube containing metal filings, which forestalls the Branly coherer of 1894, but as the cohering of the contacts is a disadvantage, he abandoned it, and regards the name "coherer" as a mistake. Contacts of iron and mercury are sensitive,but very troublesome. Iron and steel cohere, but are sensitive, and keep well when immersed in a mixture of petroleum and vaseline, which, though an insulator, does not bar the electric waves from them.

Some of these microphones, or coherers, were found, by experiment, extremely sensitive to small charges of electricity—far more sensitive than the gold leaf electroscope and quadrant electrometer. Even a metal filing on a stick of sealing wax carried enough electricity from a Leyden jar to affect the microphone it touched and give a sound in the telephone, but it had no effect on the electroscope or electrometer.

With such delicate receivers Prof. Hughes discarded the connecting wire, W, in fig. 1, and separated the receiver altogether from the transmitter—that is to say, he produced the germ of a "wireless telegraph." His first experiment of the kind was made between October 15th and 24th, 1879, the transmitter being in one room and the receiver in the next, but a wire from the receiver limited the air gap to about 6 feet. The transmitter and receiver were both connected to "earth" by the gas pipes. Fig. 5, which is roughly drawn from the Professor's own diagram, shows the arrangement. In another experiment, made about the middle of November, he connected a fender to the interrupter, as an exposed conductor of the radiations, or, to use a single word, a radiator. Instead of the fender he afterwards employed wires for the radiators and stiffened them with laths to hold them up.

Not only did he send and receive signals through space in this way all over his house, and from the third story to the basement of Mr. Stroh's factory in the neighborhood, where he employed the receiver, fig. 4, heated by a spirit lamp, but he would leave his transmitter working at home might almost say weeks, and in using the simplest means, he forestalled the great advance of nearly 20 years.

The use of an "earth" led him to make the receiving circuit through the earth, with the telephone, T, joined to a gas pipe of lead, and the microphone, M, to a water pipe of iron, as in fig. 6. The effect was very good, and he traced it to the different metals of the pipes forming a weak "earth battery,"' by which a permanent current ran through the circuit. In this case the electric waves influencing the microphone altered the strength of the permanent current. Acting on this hint, he included a battery in the circuit of the receiver. A single cell was more than enough, and even an electromotive force of 1-50th volt was sufficient.

Prof. Hughes had now got all the principal elements it seems little short of magical that in a few months, I of the "wireless telegraph" as we know it, and since he was groping in the dark before the light of Hertz arose, and walk up Great Portland street with his recever, holding the microphone in one hand and the telephone to his ear. The clicking of the transmitter could be heard for a distance of 500 yards up or down the street, and it seemed to die away at certain houses, probably because of nodes caused by interference of the electric waves, as proved by Hertz in 1887. Curious to tell, he also found that he could not hear well when he turned so that his body was interposed between the transmitter and receiver, as though he stood in his own light; but he could hear well when another person—the late Mr. Despointes, Superintendent of the Continental Gallery of the Post Office—was planted before him in the path of the rays. A trial made at the public baths, Tottenham Court Road, was unsuccessful, as the noise of the water made it impossible to hear the telephone.

In February, 1880, Prof. Hughes, intending to read a paper to the Royal Society, showed his expehiments in confidence to the president, Mr. Spottiswoode, along with the secretaries, Profs. Huxley and Stokes. At first they were surprised, but Prof. Stokes afterwards declared that "induction" could explain them, although he considered there was sufficient to make a paper for the Society. Prof. Hughes, believing that he had discovered a novelty, refused to contribute the paper. Disheartened by the adverse criticism of a high authority, he drifted into researches on magnetism, and was content to sit and see others re-discover what he already knew, without making a single claim to priority. His golden silence has doubtless cost the world some 10 or 20 years of wireless telegraphy, and I presume that if the time were to go over again he would speak, but after all it may serve to redeem the age from a charge of self-advertisement, and we need not dispair of modesty in merit, as long as we can show a man of action like General Gordon, and a man of science like Prof. Hughes.

MISCELLANEOUS.

STRAY CURRENTS.

AIR INSTEAD OF ICE.

It would be useless at this date, says the Boston Journal of Commerce, to attempt an estimate of the commercial possibilities of liquid air and those in the line of domestic use of this remarkable discovery. An eight-ounce tumbler of liquid air placed in a refrigerator will maintain the interior at a point below zero for twenty-four hours, with no expense for ice, or mess from dripping water, and no uncertainty as to results. Again, this liquid is perfectly pure and harmless, and its fumes

will carry no death-dealing germs. It is destined to be the motive power of the future, and it is equally probable that it will take the field as a high explosive.

LESS HORSES BUT NOT HORSELESS.

The Municipal Council of Stuttgart, Bavaria, has passed a law forbidding the use of horses for trucks or the heavy freight wagons within the city limits. This city ,though only three of the long streets are of smooth, level pavement, is far ahead of other continental towns in automobile vehicles for both passengers and freight. It really has no need of horses, and as the horses are in the way of the rapid locomotion of the automobiles, the city has taken the matter in hand and decided that the time has come for the horse to go. Despite the numerous hills and unpaved roads, the automobile freight wagons and carts have proved a great success. Even the Bavarian farmers are taking a deep interest in the matter, and the newspapers predict that the time is not far off when horses will be principally of use for pleasure drives.—Ex.

VISIBILITY OF LIGHTNING.

Lightning is said to be visible 150 miles. A French astronomer declares that it is impossible for thunder to be heard more than ten miles. An English scientist has counted 130 seconds between a flash of lightning and the report. If this be true, it would make thunder audible 27 miles.—Ex.

WIRELESS TELEGRAPHY.

The Electrical Review in an editorial note says that the first electrical transmission of intelligence without conducting wires was made 68 years ago by James Bowman Lindsay, Dundee, Scotland. Lindsay was a remarkable man, rising from a weaver's bench to the professor's chair, and the boldness of his plans and his predictions as to the future use of electricity stamp him as unusually acute. In 1831 he suggested the idea of conveying signals across water without using wires, and performed some successful experiments across the Tay. His method is briefly described in the proceedings of the British Association for the Advancement of Science for 1859. In 1834 he predicted the use of electric current for lightning and power purposes, and actually exhibited an electric lamp in 1834 in Dundee.

AN ELECTRIC FIRE ENGINE.

The DailyMail (London)Paris correspondent says that the chief authorities of the firemen in Paris have at last, after months of study and experiment, arrived at a satisfactory type of fire engine of which the motor force is electricity. A new electric engine, capable of seating a dozen persons, and travelling at the average rate of 15 miles an hour, and ascending hills easily and stopping quickly, has been built, and will be in use from June 1st. —Ex.

PHOTOGRAPHING WIRELESS SIGNALS.

Some very successful experiments have been made by Mr. Harry Price, of Brockley, England, in wireless telegraphy. The stations were the top of the tower of St. Mark's Church, Brockley, and the top of Aske's boys' school at Telegraph Hill, Hatcham. Photographs were taken of the currents, showing the difference between the 'dot and dash" system of the Morse alphabet by the large and small blurs on the photographic plate. The apparatus is called the Patchett-Price telephoto apparatus (wireless), and the experiments were made with the ultimate view of photographing the message upon the sensitised film. It is stated that words at the rate of 25 per minute were telegraphed. The next experiment will be between the Crystal Palace and St. Peter's Church.—Ex.

ELECTRODES FOR SECONDARY BATTERIES.

A method of producing electrodes for secondary batteries on what appears to be a somewhat novel principle has recently been devised in Liege, by which plates are cylindrical in form instead of flat. The flat plate, says Industries and Iron, is produced by rolling or casting in the usual way with the ordinary ribs for the peroxide or "active material." The plate, therefore, as completed, presents a fluted surface, which is filled with the peroxide in the customary way. Then the plate thus formed is bent into the shape of a hollow cylinder with the ribs or grooves directed inwardly and parallel to the axis of the cylinder. The longitudinal edges of the bent plate are soldered together and provided with a metal strip for the terminal. It will be seen from this description that the action of bending the plate into a cylinder must have the effect of closing the grooves to some extent at their edges, thereby enclosing the "active material" in a very simple manner.—Ex.

ELECRTIC RAILWAYS IN COREA.

H. Collbran. the American contractor for the Seoul-Chemulpo Railway, is just completing the construction of an overhead-trolley electric street railroad of some 6 miles in length, in Seoul, for a Korean company. The materials for this road are from America and Japan, the car bodies having been neatly constructed by the Japanese.

AMERICANS HONORED.

The Royal Institution of Great Britain, in commemoration of its centenary, has elected as honorary members, Professor Samuel Pierpont Langley, astronomer, secretary of the Smithsonian Institute, Washington, D. C.; Professor Albert Abraham Michelson, physicist, of Chicago; Professor Robert Henry Thurston, mechanical engineer, director of the Sibley College of Cornell University; Professor J. S. Ames of John Hopkins University; George Frederick Barker, physicist, professor of physics at the University of Pennsylvania, Philadelphia, and Professor William Lyne Wilson, ex-Congressman and formerly president of West Virginia University and regent of the Smithsonian Institute.

PROPOSED CABLE TO ICELAND AND GREENLAND.

The following communication has been received by the Department of State from Vice and Deputy Consul Blom, at Copenhagen:

The meteorologists in Europe have for many years desired a telegraphic connection with Iceland, Faroe Islands, and Greenland. Daily telegraphic reports from Iceland would be of the utmost importance to the weather service, as well as to the large fishing interests in the North Atlantic. I understand that the British fishing interests have recently petitioned the Government to grant a yearly subvention to the proposed cable. The Danish Government looks favorably upon the plan, but is of the opinion that it should be realized by private individuals. The Great Northern Telegraph Company, Limited, of Copenhagen, is willing to lay and work the cable, provided it is guaranteed a certain sum from the various governments and other parties interested. The royal Danish meteorological office, in Copenhagen, has issued circulars to kindred institutions throughout the world, requesting them to subscribe to daily weather bulletins from Iceland and Faroe Islands; the matter is also being seriously considered by other bodies, especially in Great Britain, and the prospects for a realization of the enterprise are promising.

TELEGRAPHY AND MAGNETIC INDUCTION.

S. Evershed, in an article on 'Telegraphy by Magnetic Induction' in the same journal, deduces a formula for the

mechanical energy available in a distant secondary circuit in which no capacity is used, in terms of dimensions, resistance, frequency, etc., and from this calculates that in the case of two circuits using together 1,000 kgm. of wire, each 1,000 meters square and ten kilometers apart, with a frequency of 100 and 100 watts in the primary, there would be available in the secondary .34 ergs. per second. Experiment shows that 2.9x10-6 amp. gives easily readable Morse signals in an ordinary telephone, this being double the audible current (this presumably for a frequency of 400). He then finds that in the above case, but with frequency equal to 400, there is 12x10-6 amp. and that hence the readable signals could be produced with 250 kgm. of copper. For satisfactory audible signals the frequency must be at least as high as 400, and here the undetermined effect of absorption of these waves by the material of the earth comes in. If this proves serious it may be necessary to use lower frequencies and other forms of receivers. A receiver is described consisting of a tuned rectangle of wire, vibrating in a strong field, or, better, two rectangles vibrating synchronously, but in opposite directions. Such instruments are being used at Lavernock and Flat Holm as relays to close call-bell circuits. They are of iridio-platinum wire, 3 mils diameter and 2 by 4 cm. dimensions; they have a frequency of 16 per second, and with a clearance of 2 mils .001 erg. per second is required to bring them into contact. This can be used at a distance of 10 kilometers with 1-3 ton of copper and would be less affected by the absorption; it has not, however, been adapted to the transmission of Morse signals. The power used by the telephone is more than 600 times the power used by the rectangle in this case.—Ex.

THE ELECTROLYTIC INTERRUPTER FOR THE INDUCTION COIL.

When a high electro-motive force is connected to an electrolytic cell, one electrode of which is very small, the rush of current which takes place is quickly interrupted by the layer of gas which is generated at the small electrode. This layer of gas then collects as a bubble, the electrolyte again comes into contact with the electrode, a rush of current again takes place, to be interrupted as before, and so on. These interruptions are very abrupt, and their frequency varies from two or three hundred to a thousand or more per second according to the size of the small electrode and the inductance of the circuit. The small electrode should be the anode.

Dr. A. Wehnelt (Electrical Engineer, February 16, 1899) has applied this electrolytic interrupter to the induction coil. He uses dilute sulphuric acid, a sheet of lead as cathode, and the tip of a small platinum wire projecting from a glass tube as anode. The interrupter works with entire satisfaction with electro-motive forces as high as 110 volts; the condenser, needed with the ordinary interrupter, is useless; and the effectiveness, especially of small coils, is greatly increased both in length of spark and frequency.

Dr. Wehnelt's experiments have been repeated in the Physical Laboratory at Bethlehem, Pa., his results have been confirmed and it has been found that the primary of an induction coil should be wound with more turns of wire than usual to give the best results with this electrolytic interrupter. The interrupter gives good effects when used to supply intermittent current to the primary of a small transformer. Thus a small step-down transformer taking 375 watts from the mains gave out about 30 watts from its secondary.

When the electrolytic interrupter is used to supply intermittent current from a 110 volt source to the primary of a transformer, the e. m. f. which establishes the current after each break is, of course, 110 volts, while the e. m. f. which stops the current is the e.m. f. between the break points and may be greatly in excess of 110 volts.

The effective primary e. m. f. is, therefore, on the whole, greatly in excess of 110 volts, so that a 1:1 transformer may give several hundreds of volts as its secondary terminals when supplied with intermittent current from a 110 volt source.

This is shown by the fact that a 220 volt lamp, for example, may be lighted from the secondary, and, of course, it may be lighted equally well or even better if connected across the primary terminals.

W. S. F. in "Science."

NOVEL SWITCH FOR ELECTRIC CARS.

Mr. Hiram Stevens Maxim has lately patented a new means of operating the switches of electric cars. It is well known, that in order to get quick acceleration, it is necessary that practically the whole weight of the train should rest on the drivers. It is therefore necessary to provide each car with a motor, and when several cars are coupled together in a train, as they will have to be on the Underground in London, it will be necessary to have a man to each car, or to have some device by which the driver of the front car can control the switches of the entire train, and varous devices have been thought out and patented for this purpose.

These all require some connection between the various cars other than the coupling, but by Mr. Maxim's method the drawbar of each car is attached to the switch in such a manner that the switch is operated by the tendency of each particular car to pull back as relates to the drawbar. The drawbar of each car is an inextensible rod running the whole length of the car, with a coupling at each end. This rod is held in a central position by two spiral springs, and is connected to the switching device of the car in such a manner that, no matter in which direction the bar is moved as relates to the car, it switches in the current which moves the car in the same direction. Therefore, each car follows the drawbar automatically, and the motor of each car does just sufficient work to propel that particular car. This device is of great simplicity and is easily understood, as it requires no coupling or connection between the various cars of the train except the coupling itself.—"Scientific American."

A special cable despatch to the New York "Sun" states that much interest and enthusiasm was excited at the Royal Institution to-night by Professor Dewar, who exhibited liquefied hydrogen, which hitherto had never been seen except by Prof. Dewar and a few favored persons. Those present numbered several hundreds, including the foreign delegates to the centenary of the Royal Institution. Prof. Dewar lectured on liquefied hydrogen, and showed how the air surrounding the liquid was solidified like snow. Cork placed in the liquid sunk like stone.

AMONG THE SOCIETIES.

NATIONAL ELECTRIC LIGHT ASSOCIATION. GENERAL SAM. T. CARNES.

In preparing the sketch of the life of the newly elected president of the Natonal Electric Light Association, General Sam T. Carnes, a number of slight errors were alowed to creep in, and desiring to correst the same, we give below a revised biographical sketch of the General.

Perhaps no man in all the city of Memphis is better, more widely or more favorably known than General Sam T. Carnes. The father of General Carnes was one of th epioneers of Tennessee, and the son is wotrhy of the sire. Barring a brief period of infancy, General Carnes has spent his life in Memphis. He was born in Hardeman County, West Tennessee, in 1850. He was by birth and education a military genius, and his early training and tendency have gone far towards making hi mone of the best konwn military tacticians in the country. For a long time he was brigadier-general of the State of Tennessee, thus having charge and control of all the militia of the State. This military talent was both inherited and cultivated. His father before him was quite a military enthusiast and expert, and was at

one time at the head of the State National Guard. General Carnes was elected captain of the Chickasaw Guards of the City of Memphis in 1878. This was at that time decidedly the best miltary company in the State of Tennessee, and one of the best in the nation. Engaging in many contests, they lost but few and became under his captaincy one of the most celebrated companies in the land. To General Carnes is due the first introduction of both the telephone and the electric light in Memphis, and he has been for years the president and general manager of the Memphis Light and Power Company. General Carnes was married in 1881 to Miss Kate Kerr, of Memphis, and has two daughters, aged fourteen and sixteen.

The following completes the list of officers of the National Electric Light Association, elected at the last meeting: First vice-president, Oscar T. Crosby, of Washington, D. C.; second vice-president, T. B. Cohoon, of Elmira, N. Y. The following named gentlemen were appointed members of the executive committee: E. F. Peck of Brooklyn, N. Y.; William Brock, of Paterson, N. J.; C. E. Scott, of Bristol, Pa.

ELECTRIC LIGHT AND POWER.

MEANS OF ATTAINING SAFETY IN ELECTRICAL DISTRIBUTION.

By
W. L. R. Emmet,
Schenectady, N. Y.

Read before the National Electric Light Association at its Twenty-second Convention, held at New York, N. Y., May 23, 24 and 25, 1899.

rules are based upon experience gained from existing apparatus and methods, and, naturally, cannot consider or provide for future possibilities, consequently they must be modified from time to time in order that the progress of the art may not be obstructed.

The principle sources of danger in electrical distribution are: First, heating of conductors by current; second, failure of insulation; and, third, arcing when circuits are intentionally or accidentally broken. Of the first of these causes of trouble very little need be said, since the standard system, by which a cut-out protects every conductor, is an adequate safeguard, provided the cut-out is capable of safely breaking any current to which it can be subjected. The second source of danger that has been mentioned is insulation, and this subject is one that must always receive much consideration, since the mechanical possibilities with available insulating substances are strictly limited, and since the sources of deterioration are many and difficult to avoid.

The best path to safety in electrical distribution lies in the avoidance of high-potential differences in places where life or property can be endangered. The difficulties of insulation increase very rapidly as the voltage is raised, and while it is possble to insulate for very high voltages, in small space in special cases, the difficulties multiply themselves almost in proportion to the square of the voltage increase. In electrical distribution there are two ways by which danger from high voltage can be avoided. First, by abandoning high voltage altogether, and, second, by providing means by which it cannot exist on parts of the circuit where life or property can be endangered. We have good examples of the former of these methods in the large, direct-current, three-wire systems operating

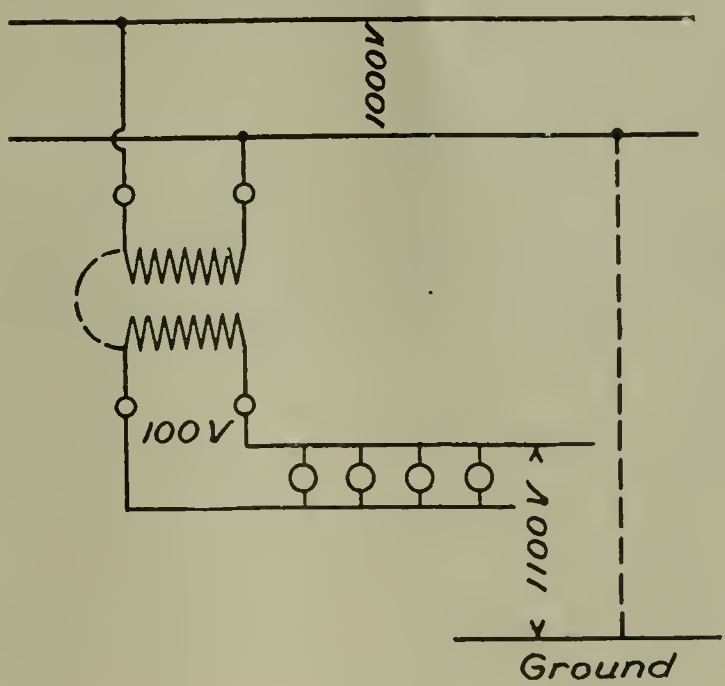


FIG. 1.

I have not selected this subject with the intention of fully discussing all its features, but rather for the purpose of bringing to the notice of this association certain matters of practical importance, concerning which radical differences of opinion exist among persons prominent in the electrical industry, and also for the purpose of pointing out some of the new problems which have been presented by recent developments of the electrical art, and which have not been fully considered in the adoption of the present standards of practice.

The persons most interested in the standardization of safe electrical methods are the fire underwriters; they have for years maintained a system by which statistics are carefully compiled and codes of rules adopted. These rules are revised from time to time, and their requirements in recent years have been nearly uniform all over the country. They have at different times been indorsed by this association, and by other bodies representative of the electrical profession, and have, as a rule, been accepted as the standard by users of electrical apparatus. These

from generators with about one hundred and twenty-five volts on a side. With this voltage the dangers from failure of insulation are very small, and I think that an investigation would show that most of the fires that have been caused by such systems have arisen from heating of conductors or failure of circuit-opening devices. The scope of such low-tension distribution is, of course, restricted, while the use of high voltages enables us to distribute over large areas with much greater economy and efficiency than is possible with low voltage alone. The desire to effect these economies has led in many places to the installation of high-voltage apparatus for supplying power to these same three-wire systems. The existence of these conditions compels us to look for means of securing safety where power is transmitted at high voltage. There is but one sure means of accomplishing this end, and that is by preventing the existence of the high potential on parts of the circuits where life or property can be endangered. We will consider some of the methods by which this end can be accomplished.

Figure 1 shows the simplest arrangement of a primary and secondary circuit as they are now generally installed in this country, and illustrates a condition under which this arrangement may become dangerous. The dotted lines show connections that may be accidentally made; one showing a cross between primary and secondary, either in the transformer or out of it, and the other, a connection of one of the primary leads to ground. The primary voltage being 1,000 and the secondary 100, the making of these connections immediately establishes a potential difference of 1,100 volts between part of the secondary circuit and the ground. This pressure will as

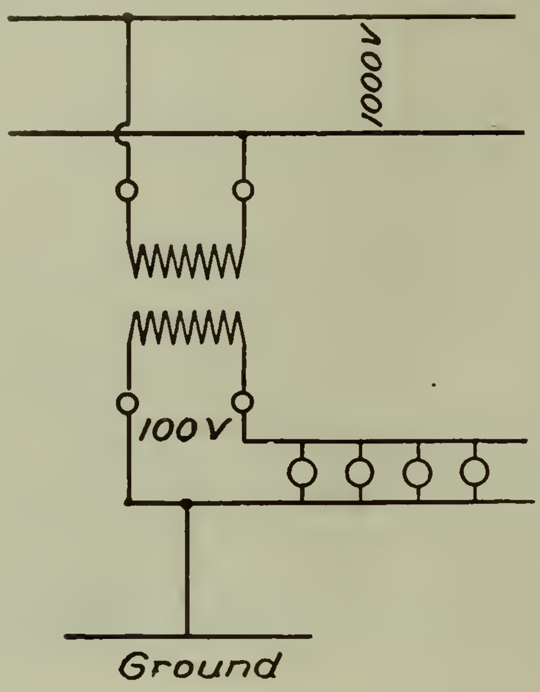


Fig. 2.

a rule, be too much for the insulation of combination fixtures, and the first indication of trouble is likely to be a fire, if it be not a shock received by someone who happens to establish a circuit through his body between the ground and some lamp socket or other part that is not sufficiently insulated from the secondary circuit. The method of installation shown in this figure is almost universally adopted wherever alternating currents are being

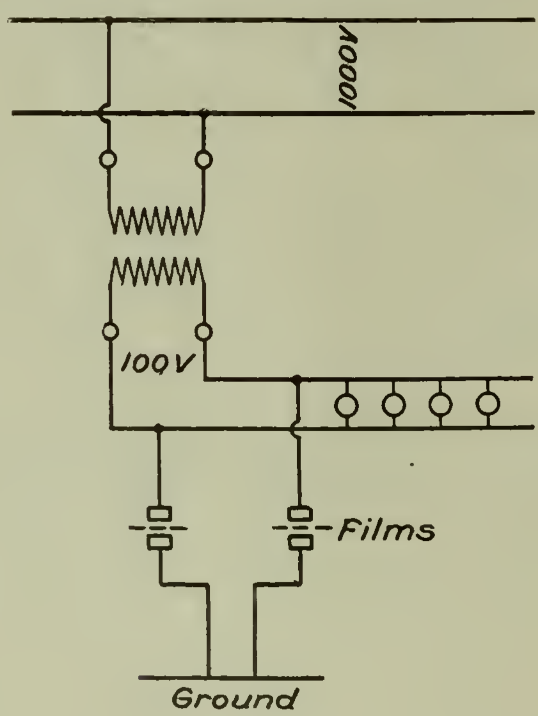


Fig. 3.

used in this country. It is, in fact, virtually compulsory upon the average station manager, since no established method of overcoming the difficulty is available that does not violate the fire underwriters' rule that all house wiring shall be free from any connection to ground. If this rule is disregarded, we may adopt the arrangement shown in Figure 2, which entirely overcomes the difficulty, and which is open to no objection except that the insulation between one side of the secondary and ground is subjected to the voltage of the secondary circuit.

With the arrangement shown in Figure 1 it is quite possible that the secondary insulation may be subjected to a considerable part of the primary voltage, even when there is no ground connection on the primary circuit. The potentials on insulated circuits carrying currents tend by static induction to balance themselves with respect to the ground is normally neutral to that of the two conductors. Where circuits are long, and operate at high potentials, a considerable flow of current between one conductor and ground may be required to materially disturb this neutrality. This has been illustrated to many of you by the lighting of ground-detector lamps from circuits that are perfectly insulated. When a secondary becomes crossed with a perfectly insulated primary, these static-capacity currents tend to flow to ground through the secondary insulation.

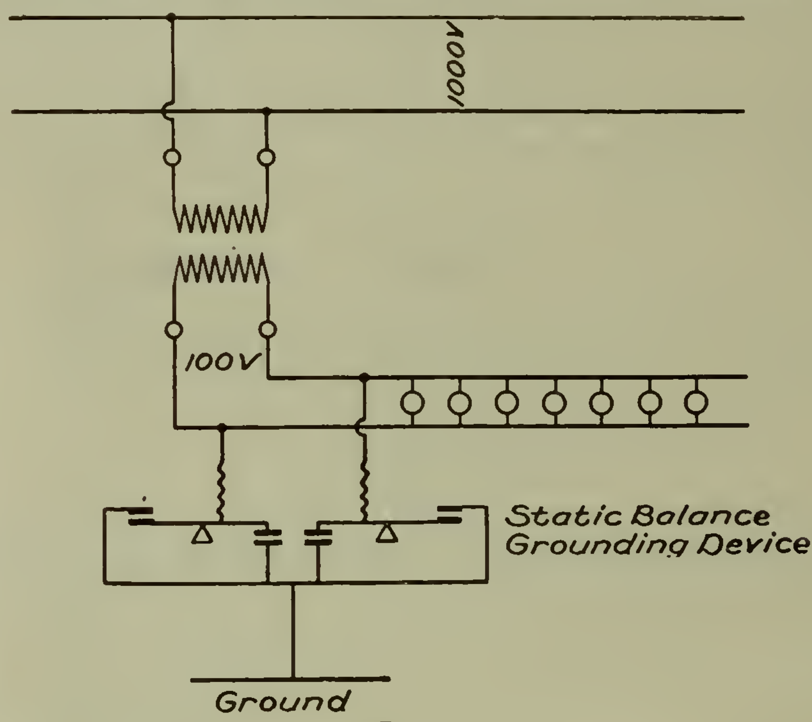


Fig. 4.

We know by experience that under the most ordinary conditions on 2,000-volt circuits these currents are of sufficient volume to light ground-detector lamps, and we know that almost any current of ordinary potential transmitting power enough to light a lamp may, under certain conditions, cause a fire.

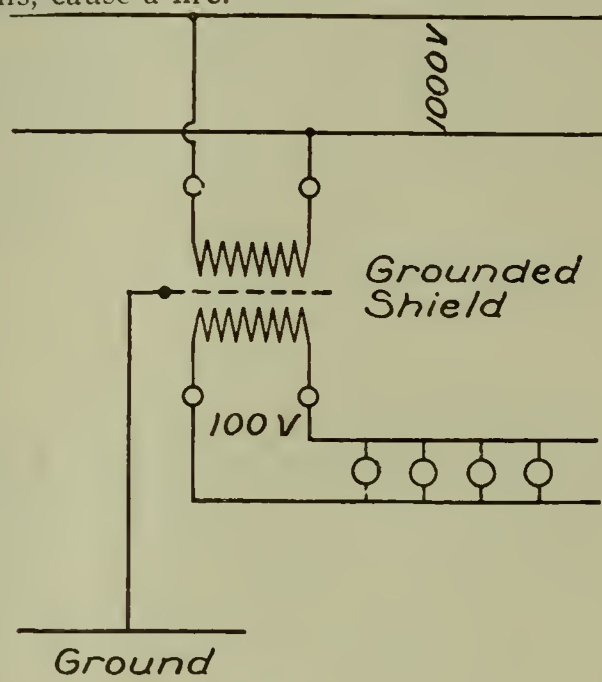


Fig. 5.

So long as the secondary circuit remains insulated from ground these dangers will exist. The remedy for the trouble must be either in the permanent connection to ground, as in Figure 2, which is now prohibited by one of the underwriters' rules, or in the installation of some device by which the secondary is grounded automatically when the emergency arises. Figures 3 and 4 show methods used to accomplish this purpose, and Figure 5 shows a method for preventing contact between primary and secondary of a transformer by the introduction of a grounded shield, which has been used to some extent, with a view

to avoiding the danger above described.

The objections to this method are: First, that it affords no protection against crosses between primary and secondary which may occur outside of the transformer itself second, that it introduces expense, since the shield must be made heavy enough to carry current sufficient to blow the primary fuses, and at the same time must be so arranged that it will not introduce serious eddy-current losses; and, third, that it probably renders the transformer more subject to injury from lightning.

Figure 3 shows the secondary separated from ground by films of insulating material, which are intended to puncture when the voltage to ground rises above a certain point. The objection to this method is that the films are likely to be uncertain and variable in their insulating qualities, and may, under certain conditions, be punctured by the secondary pressure.

Figure 4 shows the same object accomplished by means of static balances, whose motion, by rise of potential difference, causes the circuit to be grounded. Another device has been suggested, in which a magnet is placed in series with a vacuum tube between the secondary and ground. When the potential difference rises, the discharge through the tube is increased, and the magnet starts mechanism which grounds the secondary circuit. The objection to these devices is that they are not perfectly instantaneous in their action, and that the secondary insulation may break down elsewhere before they accomplish the desired result. They are also necessarily more or less complicated, and liable to fail on that account.

As I have said, the permanent grounding of transformer secondaries is prohibited by the fire underwriters' rules, which prohibition is generally respected throughout the country, so that most secondary circuits are entirely unprotected from the trouble above described. There are, however, some very important exceptions that afford useful examples of the safety of operating secondary circuits with permanent ground connections. I allude to some of the large Edison companies which have recently installed high tension alternating appartus to supply power to existing three-wire systems through rotary converters. In a rotary converter the collector rings and commutator connect to the same winding, so that the direct-current leads are as much a part of the transformer secondary system as if they were connected directly to it. Most of these large Edison companies have for years been operating with neutral conductor grounded. This grounding has in most cases first occurred through chance or accident, and the practice has been persevered in, partly because it would be a difficult matter to avoid neutral grounds, and partly because the grounded neutral is, for several reasons, very desirable.

(To be continued.)

BUSINESS NEWS

SPECIAL EXPORT COLUMN.
TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING JUNE 6, 1899, $33,425.00.

New York, N. Y., June 6, 1899.

The following exports of electrical material, electrical machinery, etc., are from the port of New York for the week ending this date:

Antwerp:—8 packages electrical machinery, $630. 54 ½ cases electrical material, $3,144.

Argentine Republic:—11 packages electrical material, $217. 1 case electrical machinery $80.

Bremen:—1 case electros, $150.

British Possessions in Africa:—92 cases electrical material, $6,808.

Brazil:—44 cases electrical material, $2,437.

Britsh East Indies:—15 cases electrical material, $374.

Berlin:—5 packages electrical material $3,746.

British West Indies:—1 case electrotypes, $15. 20 packages electrical material, $1,440.

British Australia:—8 cases electrical material, $358.

Brussels:—7 cases electrical material, $226.

Cuba:—18 cases electrical material, $663

Central America:—9 cases electrical material, $220.

Constantinople:—1 case electrical material, $6.

Chili:—1 case electrical material, $154.

Ecuador:—5 cases electrical material, $74.

Glasgow:—36 packages electrical material, $735.

Havre:—14 cases electrical material, $1,750.

Japan:—3 cases electrical material, $113.

London:—61 packages electrical material, $3,832. 27 cases electrical machinery, $2,149.

Liverpool:—27 packages electrical material, $940.

Mexico:—13 cases electrical material, $329.

Milan:—3 cases electrical material, $87.

Nice:—14 cases electrical material, $116.

New Zealand:—6 cases electrical material, $111.

Porto Rico:—1 package electrical material, $35.

Rotterdam:—7 cases electrical material, $247.

Southampton:—4 cases electrical material, $90. 12 cases electrical machinery, $635.

Siam:—14 cases electrical material, $462.

U. S. of Colombia:—39 packages electrical material, $929.

Venezuela:—2 cases electrical material, $47.

Zurich:—1 case electrical material, $76.

NEW INCORPORATIONS.

New York, N. Y.—Consolidated Electric Co. has been incorporated under the laws of West Virginia by C. P. Curtis, A. Stemmler and others; to deal in patented electrical devices, etc. Capital stock, $5,000,000.

Camden, N. J.—The P. J. Foerring Co. has been incorporated with a capital stock of $50,000; to do a general business as electrical machinists.

Camden, N. J.—The Wildwood, Holly Beach and Anglesea Electric Light, Heat and Power Co., incorporated by Spencer Stimpson, P. W. Wiltbank and others; to construct and operate electric light plants. Capital stock, $30,000.

Rogersville, Tenn.—Rogersville Electric Co. has been incorporated by C. C. Cochran, A. B. Rogan and others; manufacturing electric light and motive power. Capital stock, $5,000.

Elizabeth, N. J.—American Investment Co. has been incorporated by F. W. Montgomery, Frank Bergen and M. F. Griggs, to manufacture electric motors, dynamos, etc. Capital stock, $50,000.

Marlborough, N. H.—Marlborough Electric Light, Heat and Power Co. has been incorporated by E. B. Knowlton, C. Hodgkins, C. O. Whitney and J. H. Kimball. Capital stock, $5,000

Cohoes, N. Y.—W. J. Tindall Co. has been incorporated by W. J. Tindall, P A. Turner, C. A. Tindall and E. E. Gardner; manufacturing electrical goods. Capital stock, $5,000.

Baltimore, Md.—Acme Electric Co. has been incor-

porated by J. E. Jacobs, J. Hartman and others; to manufacture electrical novelties. Capital stock, $25,000.

New York, N. Y.—Transcendent Light Co. has been incorporated with a capital stock of $15,000.

Baltimore, Md.—The Acme Electric Machine Co., incorporated by George Heath Dobson, Jesse E. Jacobs and others. Capital stock, $25,000.

Knoxville, Tenn.—The Egbert Allen Electric Co. has been organized.

East Orange, N. J.—Merchants' Electric Light and Power Co., incorporated by Walter Ross, W. A. Himebemgh, C. F. Grosser, E. C. Dyer and C. B. McCoy; carry on the business of electric light works. Capital stock, $125,000.

TELEPHONE CALLS.

Wheeling, W. Va.—National Telephone Co. has been incorporated by A. G. Steelman, I. H. Shirk, H. M. Buck, J. B. H. Jefferson, and E. L. Ward; to maintain and manage telephone and telegraph exchanges. Capital stock, $150,000.

Albany, N. Y.—The New York Suburban Telephone Co., incorporated by Albert Deveau, William Caxton, Charles Auth, Harry A. Mott, James P. Powers, and others. Capital stock, $10,000, with the privilege of increasing it to $100,000.

Clatonia, Neb.—Clatonia Telephone Co., incorporated by S. Borkey, F. W. Jones, J. H. Steinmeyer, H. H. Jones, and H. Albert; general telephone business. Capital stock, $5,000.

Waynesboro, Ga.—W. A. Bisbee's Georgia Telephone & Telephone Co., of Savannah, contemplates constructing a system and exchange in Waynesboro.

Anderson, Ky.—The Anderson County Telephone Co., incorporated by J. J. Downey and C. P. and E. T. Johnson. Capital stock, $12,000.

Albany, N. Y.—Delaware Valley Telephone Co. has been incorporated by E. A. Goodsell, V. E. Gregory, and L. Bilby. Capital stock, $25,000.

Topsy, Mo.—Harris-Princeton Telephone Co. has been incorporated by F. M. Kolbe, E. Bushlin, J. E. Johnson, and others. Capital stock, $600.

Providence, R. I.—Providence Telephone Co., incorporated by H. Howard, H. G. Russell, R. Hazard, H. C. Cranston, and others. Capital stock, $100,000.

Pulaski City, Va.—Virginia & Tennessee Telephone Co. has been incorporated by G. M. Holstein, D. D. Hull, Jr., B. F. Garnett, B. Laughton, H. Hardaway, and G. L. Carter. Capital stock, $300,000.

Martin, Tenn.—The Weakley County Telephone Co., incorporated by J. H. Nilsue, G. W. Hall, W. T. Lawler, and others. Capital stock, $10,000.

Houston, Tex.—The Citizens' Telephone Co., incorporated by A. L. Waterbury, E. A. Glass, and others; to build, erect, buy, operate and maintain telephone lines, etc. Capital stock, $100,000.

Wheeling, W. Va.—The National Telephone, incorporated by Andrew G. Stedman and others. Capital stock, $15,000.

STREET RAILWAY NEWS.

Newark, N. J.—The White Line Traction Co. has been incorporated by George Barker, Fred W. Egner, and Edward A. Pruden. Capital stock, $4,000,000.

Providence, R. I.—Rhode Island Suburban Railway Co. has been incorporated by Albert T. Potter, Cyril A. Babcock, and H. V. A. Joslin: electric railroad. Capital stock, $2,500,000.

Norfolk, Va.—Washington Traction & Electric Co. has been incorporated by Samuel B. Lawrence, Henry M. Haviland, George E. Spencer, and others; manufacturing and dealing in railroad supplies, etc. Capital stock, $12,000,000.

POSSIBLE INSTALLATIONS.

Washington, Ga.—Harry Ludlow, City Engineer, may be addressed concerning electric lighting plant.

JOTTINGS.

UNIVERSAL ELECTRIC PULL SOCKET & SWITCH COMPANY, of 35 South William Street, New York City, manufacturers of the well known Eschwei arc lamp, pull switches, sockets, etc., will shortly move to their new salesrooms and factoryw at Nos. 401-413 E. 91st Street, between Avenue A and First Avenue. They will occupy a floor space 75x130 feet square, with 35 windows all around, affording good light, ventilation, etc.

THE CLONBROCK STEAM BOILER COMPANY of Brooklyn, N. Y., state that Mr. Frank A. Mason, formerly the secretary and treasurer of the company, is no longer connected with them in any manner whatever.

MR. FRANK M. PRESCOTT, 44 Broad Street, New York City, has opened an electrical department in addition to his talking machine and novelty business. This department will handle electrical and mechanical supplies of every description and will be under the immediate charge of Mr. A. W. McLimont, formerly with the General Electric Company. Mr. Prescott's experience in the export departments of the Thomson-Houston and General Electric companies, together with Mr. McLimont's experience as a thorough electrical engineer, will enable them to conduct this department to the satisfaction of their clients.

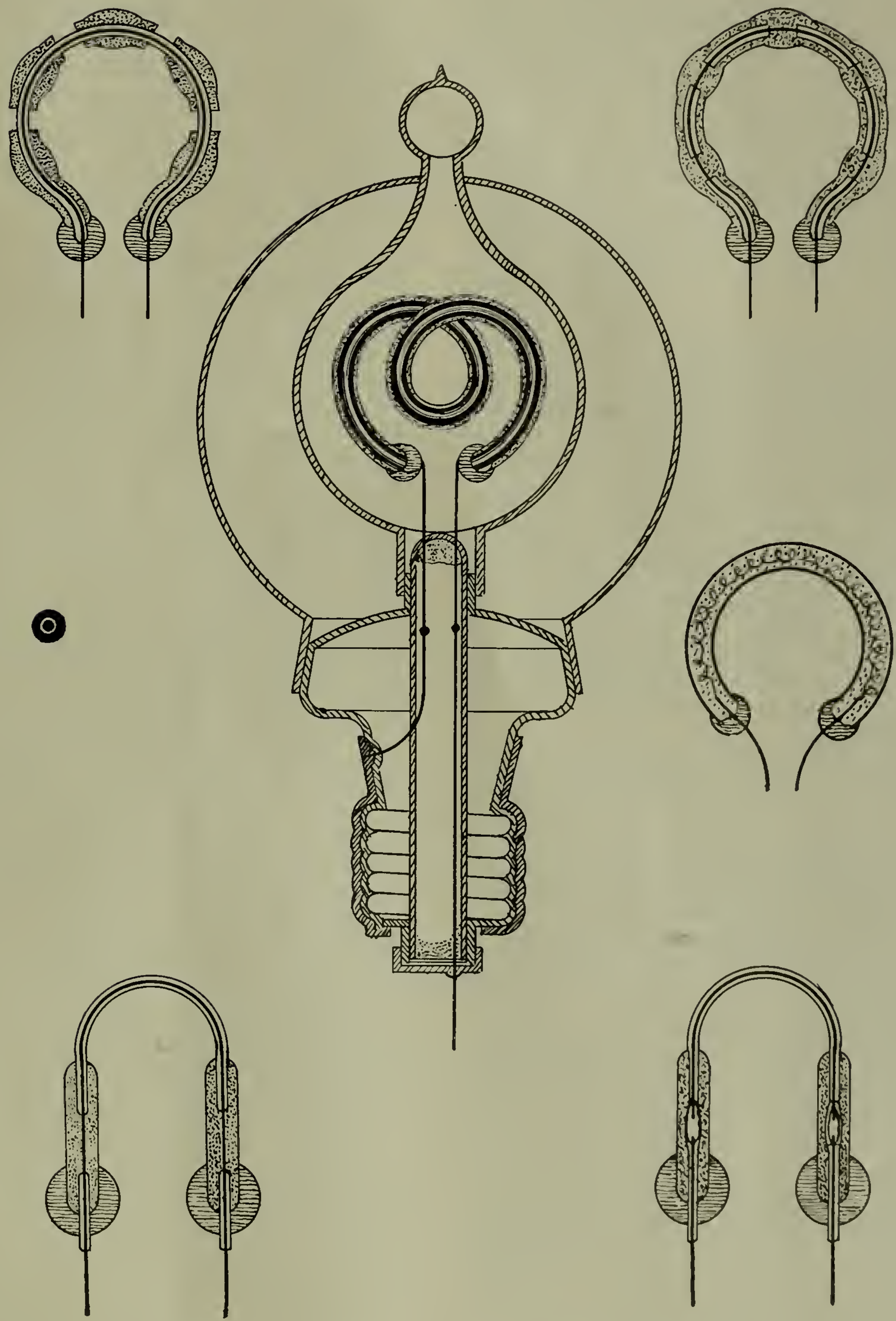
MESSRS. A. K. WARREN AND F. JAMES REILLY have purchased the entire business of the Amercan Electrical & Maintenance Company, including all maintenance and repair contracts, machinery, tools, supplies, etc. Mr. A. K. Warren, who is well known as an expert in electrical matters, will give his personal superintendence to all the work done by the company and Mr. F. James Reilly, whose father, Mr. James Reilly, was the founder and manager of the James Reilly Repair & Supply Company at 229 and 230 West Street, will have full charge of all the financial affairs. The head office of the company will, as heretofore, be 451-453 Greenwich Street, New York City.

MANUFACTURERS OF ELECTRICAL AND KINDRED GOODS are constantly in want of a good, reliable agent in New York City, and we therefore take this opportunity of recommending to their consideration Mr. F. E. Williamson, a live, active and trustworthy gentleman. Mr. Williamson has established a large business for an out-of-town industry, and now has all his time to devote to some new and ready selling article. Manufacturers and others desiring to communicate with him can address Mr. Williamson, care of THE ELECTRICAL AGE.

The Electrical Age.

Vol. XXIII—No. 25 NEW YORK, JUNE 24, 1899 Whole No. 632

ELECTRIC LIGHTING.



Details of the Cazin Rare Oxid Incandescent Lamp.

Fig 4. Fig 1. Fig. 5.
Fig. 2 Fig. 3.
Fig. 6. Fig. 7.

RARE-OXID INCANDESCENT LAMPS.

By F. M. F. Cazin, Hoboken, N. J.

If, at this date, your contributor volunteers to impart some information on the subject of utilizing the oxids of rare metals in electric lamps, I do so, because I consider it as an implied duty, to correct some errors, evidently prevailing, in relation to a subject which is creating so much interest at the present time.

The ball of journalistic discussion was started when Prof. Nernst, of Goettingen, Germany, announced to the technical world, that he had invented the electrical oxid-lamp. The most remarkable part of the announce-

ment consisted in the carelessness with which the professor ignored the prior work of Jablochkoff and others in the same field.

I derive my privilege of being heard in the premises from the fact, that public records prove my preoccupation with the stated subject since at least 1892, such proof being found in six different patents for electric lamps, issued to me by the U. S. Patent Office, all of which deal with the conversion of dark heat, produced in electric lamps, into additional light; in other words, with the use of other solids, aside of, but in connection with, the conducting element in electric lamps, for the purpose of heating them to incandescence and thus to increase the lighting efficiency of the lamps. These patents are:

No. 523,640,	on application dated	Dec. 7th, 1892.
No. 523,461,	" "	July 24th, 1893.
No. 566,285,	" "	July 24th, 1893.
No. 620,640,	" "	Sept. 11th, 1895.
No. 621,291,	" "	Oct. 29th, 1895.
No. 621,292,	" "	Oct. 15th, 1897.

(Protected also in England and Canada.)

The fact that two further applications, relating to the same subject matter are yet pending, has kept the writer silent on the subject, but the moment has arrived when he may speak.

The errors to which I refer, are in part of a technical or scientific nature and in part they relate to the question, whether the priority of invention of the exclusively practical oxid-lamp of higher light-efficiency and of longer life belongs to an American citizen or not. On the scientific side of the question we find our journalistic writers groping in the dark and befogging their own conception by looking out for evolution of mysteries, where the high-school-manual of Physics might lead them to a clear understanding.

In proof of this statement I take up from a great number of others a single issue (April 22,) of a recently consolidated electrical journal, in which I find the following editorial statements, namely: 1. "It seems to have been shown that the rare-oxids do not have the valuable property of changing heat into light; 2. Their utilization in the production of light is dependent on combustion and does not rest on any particular power of emissivity; 3. Hence it seems to be useless to expect an improvement in the incandescent electric lamp by the use of these oxids as coatings or filaments."

The first proposition, as well as the second and third, were directly based on that, which a Frenchman, Bunte, had said or was understood to have said in a paper, published by a Physical Society to which he belongs. No other authority is quoted in support of the quite extraordinary conclusions to which this paper has led. As will be shown, the Frenchman did not make the statements that are attributed to him, and if he had made them his paper would deserve less credit than a dissertation on heat, written by a high-school-pupil after his first lesson in Physics.

The first proposition as verbally cited, is a formal and general denial of a theorem in physics, which is accepted by the living generation of scientists, and which teaches, that "All Solids Convert Heat Into Light," when heated to conditional "Temperature." The second proposition falsely teaches that the heat resulting from combustion is a different heat from that produced by the electric current. This is surely new teaching, and if it be not false teaching, better evidence in its favor must be found than that which is derived from Bunte's paper, though Bunte himself advanced no such teaching, and only his interpreter (Carl Herring in "The Electrical World" of April 22) found the same therein. Heat, the one phase of energy, (force and work) is the same in its effects, whether it be the result of combustion, of electrical resistance, or of mechanical resistance, and there is nothing in Bunte's experiments and not even in his own interpretation of that which he observed to justify the assumption that with all its differences in accumulative quantity, of its latent or kinetic state, its nature and effect be such, that we must assume two essentially different phases of energy, (force and work) to be called by the name: Heat. No scientist ever claimed that any one solid material would be affected differently by heat being the effect of chemical reaction or of resistance to electric or mechanical force.

The French savant, (Bunte) experimented with the Welsbach mantel and gas-combustion. He found the Temperatures of the vapors from the combustion of hydrogen to be 300 degrees cent. less when combustion took place in the Welsbach Mantel, made of Oxid of Cerium, as against the temperature when combustion took place without such contact. Be it clearly understood that the French savant did not draw from his observations the consequences as hereabove stated. These conclusions and consequences drawn by others originated in absolute misconception of the real nature of that which really happened under Bunte's observation. In both cases, as they were stated by him, no doubt existed or could have properly existed as to this one fact, namely, that with equal quantities of oxygen consumed in the combustion, an equal caloric total effect, representing a stateable number of calories, was produced Of these calories so produced, the resulting water vapors absorbed in one case less than in the other case, and the difference was precisely measured in this, that it would raise the temperature of the vapors 300 degrees cent. higher without the oxids than with them. Where did the heat, represented by the difference in calories, go in the latter case? Which other possible conclusion can be drawn from the phenomenon observed? Which other explanation can be rationally applied thereto, than that the calories, equivalent to an increase of temperature in the water vapors of 300 degrees cent., were absorbed by the oxid? Thus the demonstration of the rapidity of absorption of heat by rare-metal-oxids, considerably in excess of the normal rate of heat-absorption, has been furnished by Bunte, and the remarkable incandescence shown by them, leaving emissiveness alone, must of necessity be attributed to rapid absorption of heat and to the peculiar faculty of maintaining incandescence under proper supply of heat.

The man Bunte is not innocent of the false interpretation given to his observations. In place of using the simplest and plainest understanding of that which he saw, he preferred to adapt himself to the modern French fashion of clothing plain things in mystic language, of rather hinting at them, and thus made use of the word "catalytic property," for which no better interpretation can be given than that it is the property of, at the same time, doing and not doing an act of chemical reaction. This mystic property had to be assumed, to avoid the exclusively true, plain and evident conclusion, that heat, being the effect of combustion, made rare-metal-oxids incandescent at a higher and more lasting rate than it does other matter, and that nothing was discovered which might indicate that heat, produced by electric resistance, would differently affect these oxids, as long as the proper proportions be preserved between heat-absorption and light emission.

The third proposition is a remarkable general denial of the practicability of a technical problem of the very simplest conception, namely, the problem of converting accumulated heat into light, such accumulation being applied to material, which at this date is in general use, for a similar purpose: the newness of the present problem consisting exclusively in the origin of the accumulative heat, and in the subtility of the contrivances which must be dealt with in the solution of the new problem The general denial is the result of the miscarriage of many attempts towards its practical solution, and of the tendency grown therefrom to deny to others the achievement that so often slipped from under the hands of the experimentor. Modern technics are not prone to abandon a rationally conceived scheme and the lack of wisdom in condemning the scheme under consideration, a fact which will become apparent, when the new lamp will be in pub-

lic use, to the exclusion of all older types, the new lamp once more of American invention.

The cited journal does not stand alone in the propogation of error in this special matter and the expression of one, when a correction of errors was tendered: "It would open certain lines of discussion for which we are not anxious," expresses well the position taken as a rule towards American inventors, for fear that the latter might enjoy some advertising benefit without paying for it, while the foreign is welcome to it at an astounding rate. I now propose to further express myself on the question of the practicability of the oxid-lamp and of work done in the premises on this side of the Atlaneic.. Yet it is not my intention to describe in full detail the different stages of evolution in the first making of an effective electric oxid-lamp, under my patents, but I may state in as few words as possible its main characteristics.

Heat—being the lamps' food, and being too valuable to allow it to indiscriminately escape into space and in such enormous proportional quantities as my calorimeter had proven to escape from a submerged incandescent vacuum lamp under current even when the bulb had been made impenetrable to light, is preserved inside of my lamp, by applying an extra glass-housing, leaving a space, air-filled or evacuated between the inner and outer bulbs, as shown in Figure 1. By permitting a minor part of the inner bulb to project and to remain in direct contact with the cooling atmosphere the special advantage is secured of condensing within such minor projecting part all the products of evaporation from the luminous body, and of keeping the bulb proper free from all darkening deposits on its inside. Incidentally, and as a matter of great economy, I designed an all-glass base-part, requiring no cementing and less manipulation in the manufacture of the lamp. Although these features of economy and of heat-preservation formed part of an earlier specification, they had to be relegated to a later separate specification, which resulted in patent No. 621,292.

Passing from these features to the more (or equally) important one, relating to the luminant proper of the lamp, a short review of its evolution may be given. My experimental work had brought forward a number of essential conditions necessary in a successful and really practical electrical rare-metal-oxid lamp. In the matter of conductivity it was found, that a luminous body of carbon and oxids in direct contact not only rapidly decreased in resistance, but after once having been exposed to the current and then been switched out of current, and after cooling, it had entirely lost its conductive quality. An investigation showed that the carbon-filament had almost entirely disappeared, and a very irregular scattering of spots of reduced metal remained on the contact face of the oxids. When I applied the remedy of chemical insulation by coppering the carbon-filament or of gilding a filament of some metal equally apt to oxygenate as carbon, though of an extremely high point of fusion,—I found that in so far as I properly regulated the resistance of the entire conducting element, I had made a successful electric oxid-lamp, such regulation finding its expression in the spiral form of the conductor, as shown in Figure 2. But in case of resistance being regulated to produce heat only in the conductor, and not light, or in cases of insufficient resistance I had to intercept the insulating coat by ring-shaped intervals to prevent increase of conductivity. While this resulted in a practical luminant, not only did the exterior, corresponding to the interceptions of insulation, appear in more brilliant incandescence but investigation showed that also in this case the stated reaction had taken place but had been confined to the narrow annular interceptions, causing an alloy-coating on the contact face. This metal-coating, co-jointly with reduced metal from the oxids, seemed in second use of the lamp, to have acted as the conductor until the oxids, sufficiently heated, filled the gap; or, the conductor stubs acted as arc-pencils, until the oxids became conductive and offered less resistance than the automatically intercepted filament. In this connection attention should be directed to the important fact that no arc lamp proper or such in its function can possibly utilize rare-metal-oxids for increase of light efficiency, for the simple reason, that oxid-pencils do not conduct and that in order to become fit for such utilization, the arc lamp must cease to be an arc lamp and must become a continuous conductor lamp or a filament-lamp, by inserting the hot oxids, as conductors. With a continuous conductor of practical success consists in so regulathe condition of practical success consists in so regulating the initial resistance that it be higher than that of the heated oxids.

I took advantage of the experience thus described in some instances by applying the coat of oxids only to those parts of the conductor where the insulating coat is intercepted, and where they show higher brilliancy of incandescence. But in locally bridging over the gaps in the insulation,I still preferred to decrease the solid volume and to increase the light-emanating surface by applying the oxids in the shape of pseudo-fibres or frabrics, fritted into adhesiveness and cohesiveness by an admixture of fluor-spar and the application of momentary excessive current, to the well-protected conductor.

It is a fact well worth the attention of investigators that the patent, No. 566,285, applied for, as early as July 24, 1893, and issued on August 18, 1896, describes in its fourth claim the form of luminous body, which has lived out the tests of hundreds of others, and describes precisely the relation of the conducting element to the oxids, as all experimental work has finally proven it preferable and exclusively practicable. The cited claim reads:

"4. In an electric incandescent vacuum lamp a solid body surrounded by a vacuum, bearing in or on its face, and integral therewith, lines or films of semi-conductive or carbonaceous matter; the said lines or films being adapted to become incandescent under the electric current and being also adapted to heat the solid body by means of the dark heat-rays produced by the electric current under adequate resistance, as and for the purpose set forth."

While in this patent, as applied for in 1893, the vacuum-lamp is exclusively considered, and the conducting element is specified as "semi-conductive or carbonaceous matter," a similar claim in a later application, now also allowed, reads as follows:

"13. In an electric incandescent lamp a solid body, as luminant part thereof, bearing in or on its face, and integral therewith, a metal-filament, being adapted to become incandescent under the electric current and to heat the solid body by means of the dark heat-rays produced by the electric current under adequate resistance."

It is evident, that with a fully protected core the vacuum may be dispensed with, in the manner as provided for in my patent No. 523,461.

If I add to the preceding discussion the adjoined seven figures, both principles and details of execution in my oxid-lamps will be understood. Figure 1 shows a complete lamp in longitudinal section. The luminant, in this case assumed as flexible, consists of the filament proper —the insulating and the oxid-stratum.

Figure 2 shows a normal section of the luminant. Figure 3 shows a chemically insulated metal filament, in spiral form, imbedded in a porous oxid-body, such as at present manufactured. Figure 4 shows an insulated (protected) filament with a series of oxid-bodies made of pseudo fibre of rare metal-oxids. Figure 5 shows the insulating stratum with annular interceptions, and a continuous coat of oxids. Figure 6 shows a conductor of the same class as in figure 5, but partly uncovered by oxids, as in a case

* The modifications of the so-called Nernst-Lamp without extra contrivance for heating a "strip of oxid" and the one with a "conductive line" over the strip are thus evidently fortified by the Cozin patents.—The Ed.

when the conductor is intended to remain dark and impart heat enough to one or more oxid-bodies in order to render them incandescent. Figure 7 shows the effect of use in luminants, constructed like the last mentioned one, while remaining in good shape for further use. There still remains for me to say a few words more on the manner in which my different inventions have been protected. No. 620,640 secures the luminous body of the conductor and oxids with the indispensable intermediate insulating stratum, in proof of which I cite but one out of a dozen claims, namely: 1. "A three-part electric incandescent vacuum-lamp consisting of a suitable base, an air exhausted glass bulb, and a body or structure of solid matter, which latter part constitutes a cohesive entirety, and as such consists of two main constituents, namely of a continuous, linear semi-conductive, current-passing filament, which resists a passing electric current to the effect of giving off light and heat and which filament is electrically and chemically insulated from the other constituents by a protecting stratum and a stratum of matter, which by the heat given off by the filament, becomes luminous, as and for the purpose set forth." But the same patent secures also the luminous body of oxids, with a filament of material not in affinity with oxygen, by the claim. 3. "A three part electrical vacuum-lamp, consisting of a suitable pole connecting base, an air exhausted glass bulb, and a body or structure of solid matter, which latter part consists of two, more or less, adhesive parts, which are in permanent contact with one another; these parts or constituents being: A linear continuous semi-conductive, current passing filament, which is electrically and chemically neutral or insulated as against the other constituents, and solid matter, that is peculiarly adapted to become luminous by heat and exceeds in main volume that of the filaments, as and for the purpose set forth." No. 621,291 secures the use of oxids in the shape of pseudo-fabrics, as may be shown by citing two claims out of eight, namely: 6. "In an electric incandescent lamp a luminous body, which consists of two or more cohesive parts, namely an inner or filament part and an outer part or parts, which mainly consist of refractory rare-metal oxids, such outer part or parts covering the inner part in part only, as and for the purpose set forth." 8. "In an electric incandescent lamp a three part luminous body, consisting of an inner core and filament, of an insulating stratum on such core, and of an outer partial cover or pseudo-fabric of rare metal oxid, as and for the purpose set forth.

Preparations are being made for putting the lamp into the open market, and I must ask for patience for a little while, until it will be made public property. It will then be time to speak with full precision of the virtues of the new lamp, which aside of the regular current, requires no other, and requires no flame and no magnets to set it a-glowing; has no features of any practical doubtfulness, and which costs only a few cents (and not dollars) more to make than the present lamp, and is protected by priority and by broad and specific claims in all its essential features, and which cover the whole practical ground to the exclusion of all more recent attempts in the same direction. Common justice calls for a few words also about the position assumed by the Patent Office in relation to this matter: In an application filed on Dec. 26, 1882, Thomas A. Edison, amongst other things, says of a filament-coating "not decomposable by carbon" (hence not possibly oxids), that "the light will therefore (thereby) not be lessened." And yet his patent containing these words is considered a bar against oxids coating a carbon filament. Only the fact that the luminant so described is auto-destructive, prevents Edison from claiming the modern oxid-lamp. But his laurels must not wither. He therefore, on March 31, 1898, applied for a patent on oxids with carbon particles in the pores of the oxids. Thereupon the Patent Office conveniently overlooked the fact that it had issued to me, on application dated Oct. 29, 1895, a patent (No. 621,291), in which a luminant is disclosed, being a body of oxids mainly with the residue of carbonized substance of a fabric embedded therein, and issues patent (No. 626,462) to the genius who of necessity must discover all that is worth discovering. Again Edison has overlooked the important fact, that carbon and oxid are auto-destructive, the carbon disappearing. If the particles of carbon could establish a pre-heating current, they could not do so very long. Osmium is no better in contact with oxids than carbon is. It is in this that the proclaimed invention of Baron Auer von Welsbach will strike the snag opposing successful navigation.

MISCELLANEOUS.

STRAY CURRRENTS.

TELEGRAPH LINES OF THE WORLD,

The approximate mileage of the telegraphic and telephonic lines of the world, according to "Engineering," is 2,029,893, and the miles of wire amount to 8,254,004; of telephone lines only there are 382,417 miles involving the use of 3,202,950 miles of wire.

HARD SOLDERING WITH ACETYLENE.

The flame of acetylene is exceedingly useful for hard soldering, says Neueste Erfindungen und Erfahrungen. Its temperature is as high as can otherwise be obtained only with a special blowing apparatus. The heating power of acetylene is is likewise very great. The use of acetyline is particularly in place where no connection with a gas house or electric central station can be had.—Ex.

HOW'S THAT FOR HIGH ?

Give a man an inch and he goes to—we mean takes an ell; but the fair sex for the same proportion of the foot demand an Otis elevator, judging from the following copy of a letter addressed to the Otis Elevator Company, Limited: "Will you send me the price and particulars of your elevators. I am going into business in a showroom, but I must be an inch taller. Hoping you (? I) can rely upon them being genuine; if so, I shall be able to give you another order for a pair. Hoping you will let me know as soon as possible, as I am wanting them this week." The company cannot elevate her, so the lady remains in stature quo.—Ex.

THE MANACLES.

With reference to the recent disasters to the Mohegan and the Paris, the Rev. W. Iago, speaking recently at a meeting of the Royal Institution of Cornwall, England, stated that that institution nine years ago sounded a note of warning in regard to the magnetic properties of the rocks in the Lizard district, which might have caused vessels to steer a wrong course by deflection of the compass needles. The Manacles had an affinity for the magnet equal to only one ton in 3,000 tons, but other rocks in that district were much more powerful in attraction. It remained to be seen whether the lighted and sound-producing buoy to be provided would be a sufficient warning.—Ex.

ALUMINUM FEEDERS.

According to the "Railway and Engineering Review" of Chicago, the North-Western Elevated Railway of Chicago has entered into a contract for 150,000 pounds of aluminum feeders. Three sizes of bare cables will be used—785,000, 1,000,000 and 1,300,000 circular mils in area respectively. The largest feeder will be about 1½ inches in diameter. Of the two larger sizes there is to be two cables of more than 10 miles in length each. The feeders will be placed in a wooden box or trough covered by a board walk between the tracks, and they will be supported on vitrified clay blocks of umbrella shape, placed 9 feet apart. The contract was made on the basis that 47 pounds of aluminum are equal in conductive capacity to 100 pounds of copper. Experiments carried out by the electrical engineering department of the road have demonstrated that 157 circular mils of aluminum are equivalent in carrying capacity to 100 circular mils of copper.—Ex.

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NEW YORK, JUNE 24, 1899.

CONTENTS.

THE COST OF CALORIC ENERGY.

It may seem rather strange to discuss the subject of heating during the present season of semi-tropical weather, but this, like other problems of general interest, requires consideration. The use of electricity for cooking has become established as a paying application of this force. For the heating of cars and homes the subject requires some further analysis because of its doubtful cost. By burning coal in a well-made stove sufficient heat is obtained to make us feel that a reasonable return has been effected for the fuel consumed. Neither the cost of this fuel seems too great nor the amount of heat insufficient, and in consequence of this any proposition relating to the production of caloric energy must fall within these limits. Comparing the relative cost of producing heat by electricity and from coal it is easily seen that at present the former is a luxury which few can indulge in. In other words, car heating and house heating by electricity means large bills for current.

The enormous amount of power stored away in a pound of coal, which can be transformed into heat, is not appreciated by the lay mind. The novelty of a new method frequently interests them more than the inexpensiveness of an old one. As far as we can see the use of electricity for heating depends entirely upon the cost of a horsepower within the house. Burning coal at a distant station, utilizing fourteen per cent .in the steam engine, ninety per cent. in the generator, and ninety per cent. in the lines or underground conductors, leaves us at the street service in any given home about eleven per cent. to utilize. If we consider the house conductors, about ten per cent. of the enrgy of the coal burnt in the distant station is left at our disposal. By burning coal in a stove from forty to sixty per cent. of the heat developed escapes up the chimney. If we consider the labor involved in making a fire, and tending it at so much an hour, and add this additional expense to the cost of a given amount of heat, a stove becomes somewhat more expensive to operate than might at first seem true. A servant caring for a stove, costing fifty cents a day for labor alone, would bring up the account for fuel, with her wages added, to one dollar or more. For a dollar an electric heater, consuming one horse-power, can be run for twenty hours.

There is neither labor, uncleanliness nor inconvenience associated with an electric heater, which therefore brings it not only to the front as a fairly cheap device to operate, but allows it to assume the unique position of being more convenient than any other known form of heating apparatus. In a small family, where labor is of no consequence, as far as the attention of a stove is concerned, the burning of coal is certainly cheaper, but in well-equipped homes, in apartment houses, hotels, etc., where the care of either a steam-heating plant or fifteen or twenty stoves must be considered, electric heating could hold its own.

Another point to be remembered is that the price of electricity is diminishing instead of increasing, which leads us to suppose that when the power companies see fit electric heating will be universal in large cities. On street cars it is undoubtedly cheaper to run electric heaters, which can be switched on and off at a moment's notice, than to put in stoves, which not only require care and attention, but occupy the room of at least two passengers, besides inviting the risk of fire. For street railway purposes it seems evident that a coal stove is a wasteful extravagance and that electricity for heating is really cheaper.

ELECTRICITY IN SURGERY.

The general public are apt to be interested in all applications of electricity relating to their own bodies. The idea that electricity is a mysterious and life-giving agent has been so thoroughly inculcated in their minds that an adverse opinion is apt to be disregarded. As it is, the uses to which electricity are put do not enter into that field at all. Electricity is a curative agent; it may be regarded from three general standpoints. First, the use of the current, or at least of a charge of electricity, for certain nervous disorders. Second, the use of electricity for sending drugs into the tissues, as in certain departments of dentistry. Thirdly, its use as a mechanical agent, as it were, for operating drills, saws, cautery appliances, etc. In speaking of cures effected directly by the agency of electricity it is not necessary to annex that newer field of work which includes all applications of the X ray. In surgery, as practiced at our largest hospitals, strange as it may seem, electricity is only used for cautery purposes and occasionally for operating saws. It is only in the practicing physician's laboratory that we find the apparatus used for electro-therapeutic experiments.

In France electricity has been used in cases of rheumatism, gout, etc. A cataphoric method is employed and mineral deposits within the bones or tissues have been effectively reduced by the use of a current intelligently applied. There does not seem to be any possible lack of uses for electricity in either medicine or surgery, but more a lack of direct and positive applications. Were systematic experiments carried on no doubt discoveries would be made in both the fields of surgery and medicine.

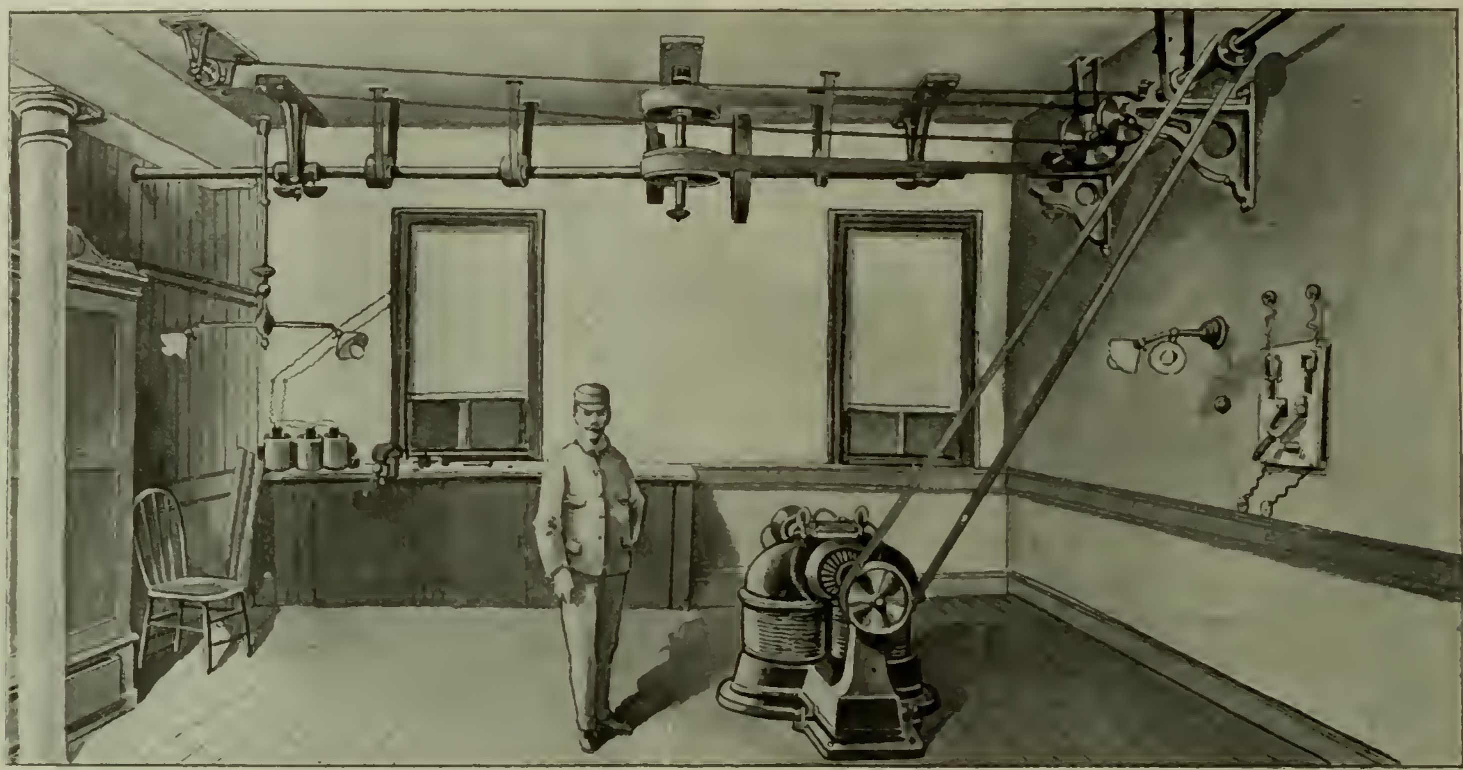
Pacolet, S. C.—The Pacolet Telephone Co. has been incorporated by G. E. Ladshaw, W. F. Bryant and T. C. Brown to run a telephone line from Pacolet to Spartansburg. Capital stock $800.

ELECTRO-THERAPEUTICS.

ELECTRICITY AN AGENT OF MECHANICAL MASSAGE IN THE ZANDER INSTITUTE.

Nowadays one can indulge in almost any form of exercise, even the most violent sort, with less exertion than is required to swing a hammock or control a rocking chair. The up-to-date athlete need merely stand before a great complicated machine, touch a button, and an electric current does the rest. These mechanic gymnastics, as they are called, are almost unknown in America, though they are in common use in Baden-Baden and other Continental health resorts. These mechanical gymnasiums are known the world over as Zander Institutes, after their inventor. They are so expensive to equip that in European countries they are owned or subsidized by the governments. The only Zander Institute in America, at 20 West 59th street, New York City, contains some $50,000 worth of apparatus alone. The Zander treatment has of late become a fashionable fad in New York.

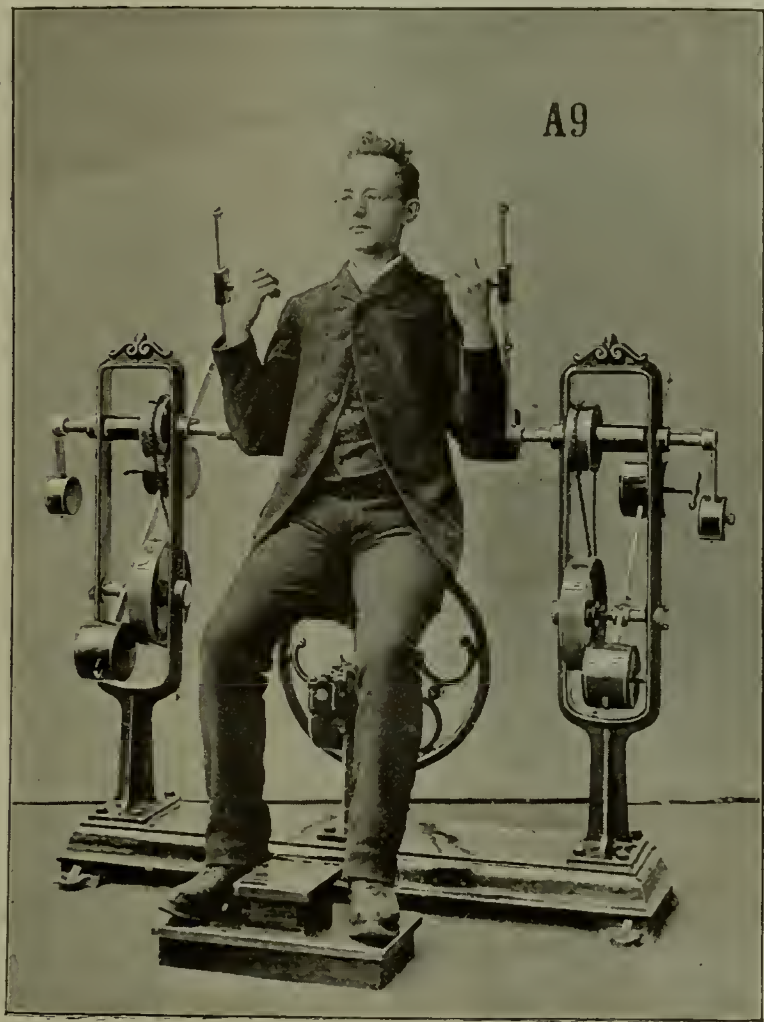
The mechanical gymnastic mechanism is operated by electricity, and is besides used in connection with other electro-therapeutic treatments. The success of the Zander treatment, the smoothness and facility of the working of the machines, and their accuracy of control, are very largely due to the use of electricity. This motive power makes it possible to transmit the comparatively larg quantities of energy required to operate these heavy machines to elegantly appointed apartments without any unsightly connections, noise, dirt, or confusion of any kind. The motor used is a 220 volt machine. For ordinary use it



Motor Driving Massage Machines.

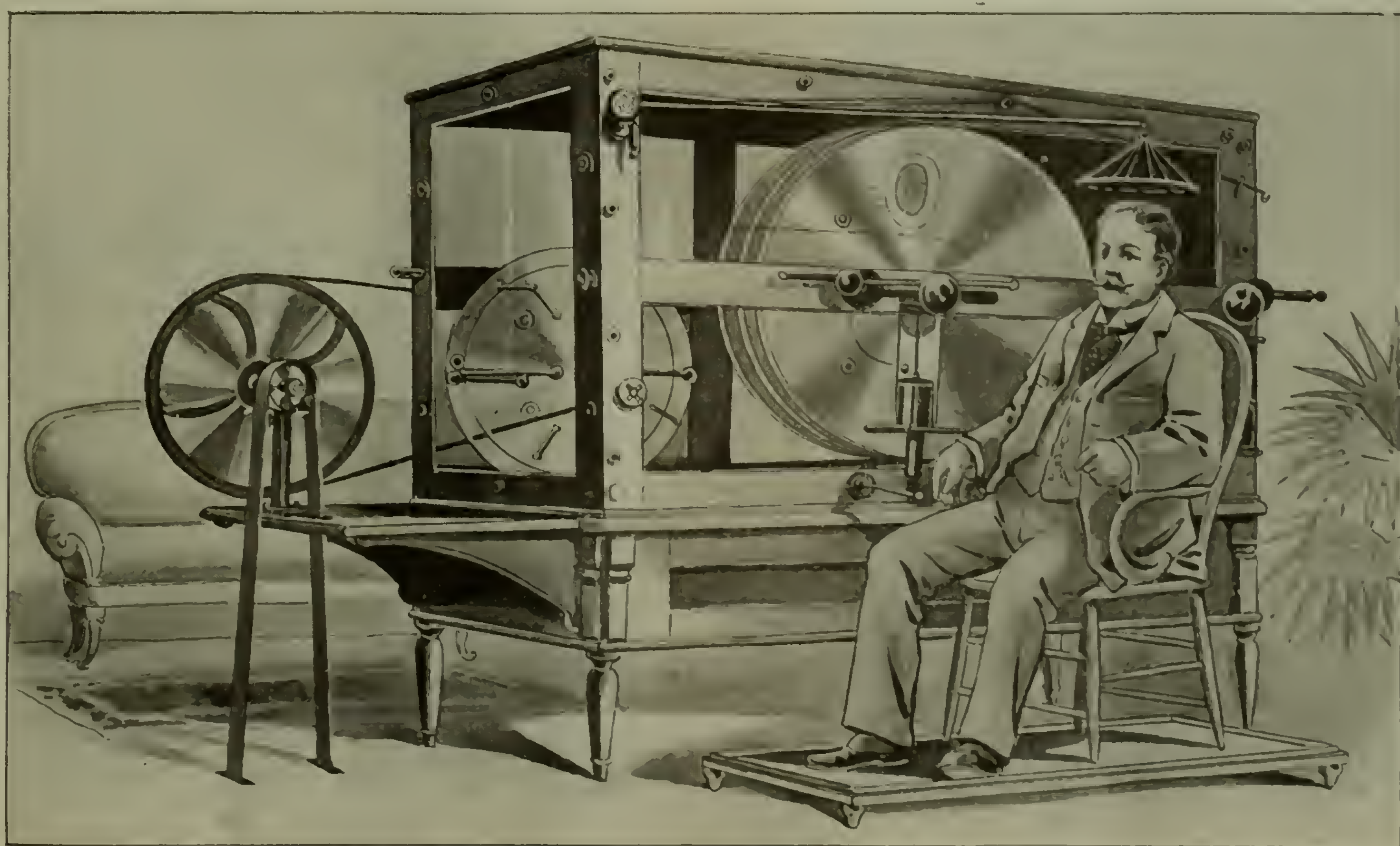
Main Floor of the Zander Institute, Showing Electrically Operated Machines.

has been found that seven and a half horse-power is sufficient to operate the machines. The speed of most of the machines is comparatively high. The mechanism used



Machine for Producing Flexion of the Muscles of the Arm

for the vibratory work runs at a speed of from 800 to 1 200 per minute; a powerful static machine is also used in connection with the other Zander work. It is safe to



Waite & Bartlett Static Machine.

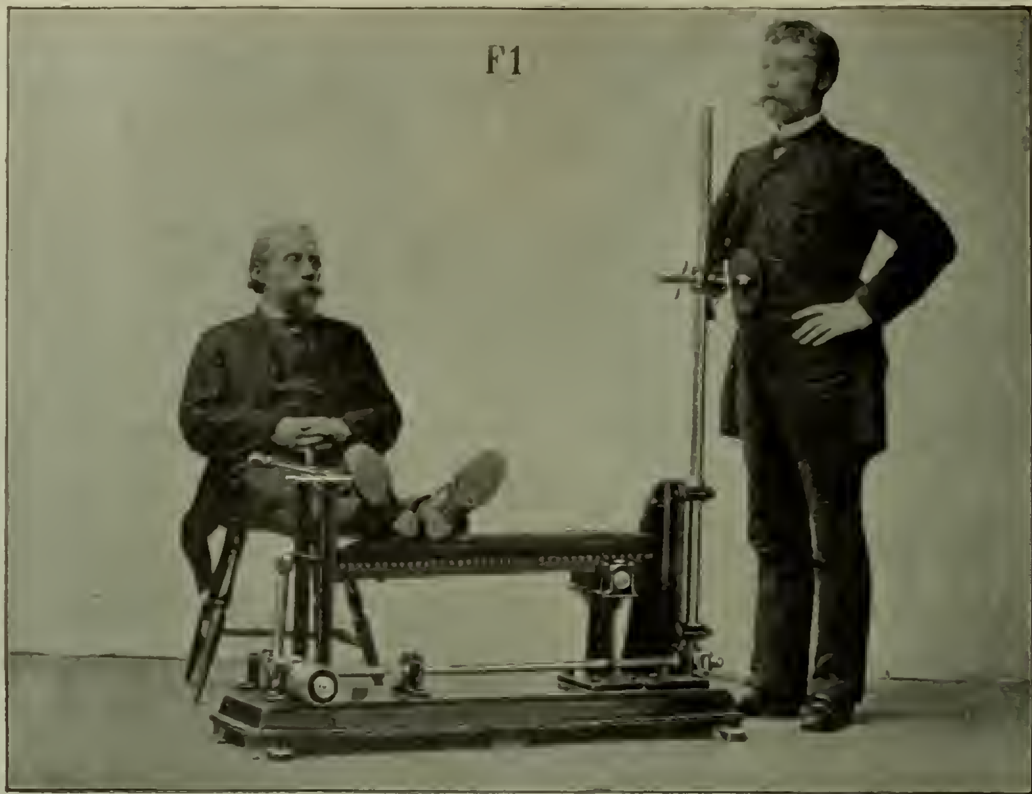
say that there is scarcely another machine shop, for such the Zander Institute virtually is, which can boast of such elegant appointments and in which the power is developed, transferred and consumed with so little confusion.

The gymnasium looking down on Central Park has apparently a different machine for exercising every muscle

Mechanical Horse.

of the body. It contains automatic camel and horseback riding mechanisms; curious contrivances which massage the body with deft, rapidly moving rubber fingers; ingenious affairs which rub any part of the body with the skill of an expert masseur, and scores of other movements. The theory of all these complicated machines is exceedingly simple. They merely aim to give the muscles the

movement they would have were regular exercise taken, without the patient making the least exertion. This curious passive sort of exercise is usually accompani.d



Vibrating Machine for Ankle and Abdomen.

by the mechanical vibration or massage machines which set the blood in motion and thus stir up the entire body. Any one who has experienced the exhi'arating effects of massage will perhaps understand the stimulus of having these rubber fingers pat him on the back at the rate of 900 vibrations per minute.

A very well patronized machine is the one which gives mechanical massage for the "Monday morning head," or "katzen jammer." This apparatus operates four rubber loops or fingers, which move up and down and deliver little taps at the rate of about one thousand a minute. The rubber fingers can be arranged to strike any part of the body. The patient suffering from a "Monday morning head" stands in front of the machine and holds his head so that these little thumps will rain down upon him.

Machine for Measuring Muscular Developments.

Machine for Administering Mechanical Massage to the Spine.

The rubber fingers move very much like the fingers of a pianist, only very much faster. These little blows, after a few moments, cause the blood to flow more rapidly, and the congested feeling soon disappears. The blows are arranged to strike so lightly that the sensation is very pleasant and exhilarating. There are several machines, especially adapted for rubbing, which can be adjusted to play upon any part of the body. A stiff joint or limb can be limbered up in this way very often in less time than it takes to tell it. There are several forms of machines for treating the ankle alone. A stiffened ankle, for example, is placed on a pedal, and, after being carefully adjusted, moved through a certain fixed distance at any speed up to 10,000 vibrations a minute.

One of the most valuable devices in the Institute is a complicated machine, fitted with a cushioned chair with padded arms and back, in which the patient sits very comfortably. After being carefully adjusted the machinery is set in motion and the chair suddenly becomes alive. The arms move until they reach the arm socket, and then gradually expend the chest while the back moves forward, holding the body in a perfectly upright position. An instant later it gradually relaxes. The lungs are thus expanded and filled with pure air without the least effort. It will readily be seen how the lungs are enlarged in this way, all the muscles being more or less brought into play. The various forms of vibration machines which are used in connection with this are the most popular in the gymnasiums. One of them consists of half a dozen rubber fingers which move up and down the spine while the rubber tips deliver blows at the rate of about 1,000 per minute. The machine simply does the work of an expert masseur and does it about one hundred times faster. The rapid movement sends a warm glow all over the body. There are a number of devices beside for rubbing the arms or any part of the body by rapid mechanical movements. One usually comes from a gymnasium more or less tired out, but the mechanical gymnasium reverses this operation and sends the patient away refreshed.

The machines used for giving regular gymnastic exercise are complicated contrivances which are adjusted for each gymnast with great nicety. Instead of working with weights and pulleys in the ordinary hit or miss fashion of the regular gymnasiums, the patient moves long levers, accurately marked off into inches. The weight is then adjusted carefully to suit the strength of the gymnast. The levers are then moved for a fixed length of stroke, so that they bring the strain exactly where it is needed, and the muscle is besides subjected to an even strain throughout the stroke. The machines are fitted to upholstered chairs or supports, so that the body, except for the particular muscles being exercised, will be kept absolutely at rest. These machines, it will be seen, make it possible for one to pick out any particular muscle and develop it with great care. A number of singers, for example, have taken the thumping and rubbing of these Zander machines in order to develop the respiratory muscles and the diaphragm. Almost any wholesale exercise may suffice to develop these muscles, but mechanical gymnastics, by treating the muscles directly and separately, serve to give one the control over them which means so much to the singer. After a little of this work one begins to discover entirely new muscles and a new use for many of the old ones. Since it is of the utmost importance for a singer to have complete control of the muscles as well as strength in them, it will be seen what this curious treatment means.

The most violent forms of exercise in the gymnasium are the automatic horse and camel back rides. A very complicated and expensive machine is required to give these movements. The machines which reproduce the motion of these animals are arranged with saddles, worked by a series of cams, operated by electricity. Any one who cares to take one of these journeys mounts the saddle, an attendant touches a button, and the machine starts off full tilt. The maximum speed is one mile in three minutes, or 120 vibrations. These contrivances face the windows which look down on Central Park, and it does not require much imagination to think one is actually galloping over the shaded bridal paths below. The machines are provided with little hour glasses which tell just when the rider should pull up and dismount. The saddle of the automatic camel is much broader than that used in horseback riding and is without stirrups or bridle. The rider's feet, as a result, are kept very far apart, and one is unable to either support himself by his feet or by holding on to the bridle. A mile in six minutes is considered very good speed on this machine, or the equivalent of 80 revolutions of the shaft. The rider sits erect and places the hands on the hips. The camel ride is a very violent form of exercise, and a little of it usually goes a long way. For certain nervous disorders electro-therapeutic methods are applied, the Waite & Bartlett static machine being utilized, the electric spray, or discharge, being used. The static machine is driven by a separate six-horse Crocker-Wheeler motor.

ELECTRIC LIGHT AND POWER.

MEANS OF ATTAINING SAFETY IN ELECTRICAL DISTRIBUTION.

By
W. L. R. Emmet,

(Continued from page 323.)

Figure 6 shows the condition existing in such cases. In these cases two rules of the National Board of Fire Underwriters are violated: First, the secondary system to which all house wiring is connected is permanently grounded; and, second, a primary voltage of 6,000 is used, while the underwriters' rules state that house wiring must not be connected to the secondaries of transformers whose primaries receive current at voltages

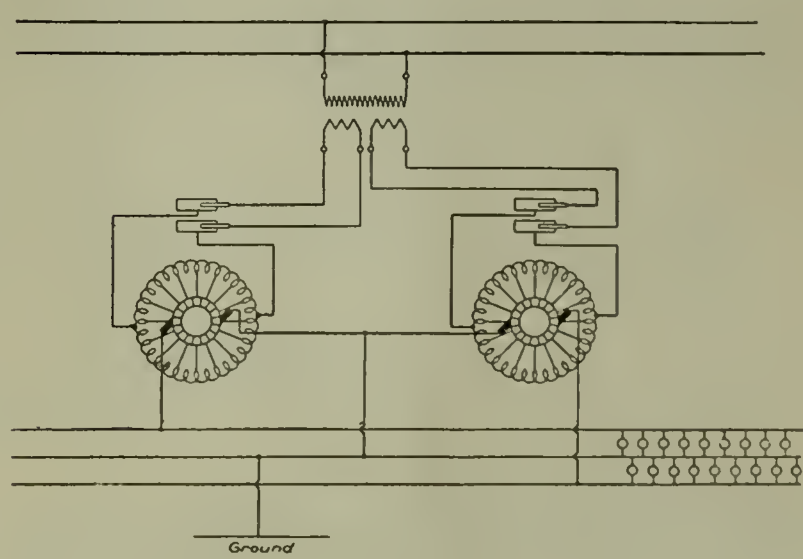


FIG. 6.

above three thousand. In spite of these violations, the circuits are just as safe as they were before the high-tension power was used, and safer than they were before their neutrals were grounded, although at that time no high-tension apparatus had been installed. Both of these rules should, and in time will, be abandoned; the first, because it leads to danger rather than safety; and the second, because it endeavors to fix an unnecessary barrier to progress. The interests of insurance companies, as well as of users and manufacturers of electrical apparatus, are best served by the introduction of methods which conduce to economy in the broadest sense.

A forcible illustration of the danger of ungrounded secondaries is afforded by a recent occurrence in New Orleans. In a certain residence district, where houses

were connected to a system of three-wire alternating mains, a cross caused by wind occurred between one of the main wires and a 2,000-volt primary wire in the same street. The result was that the insulation between wiring and ground was broken down in a large number of houses, the trouble being principally in combination fixtures where conductors were near gas pipes. Fires occurred in twenty houses and several were totally destroyed, among which were some fine residences. The loss was over $200,000. If the neutral of this system of mains had been grounded, this trouble could not have occurred.

There is but one condition necessary to safety with a properly grounded secondary; namely, that there be no possibility of the accidenfal introduction to the secondary system of sufficient primary current to blow the secondary fuses. No possible set of conditions can arise where this precaution cannot be provided, since portions of primary circuits occupying the same streets with secondary mains can easily be protected by fuses, if the total primary current capacity exceeds that of the fuses of the devices. Fuses, switches and circuit-breakers are subjects upon which a great deal could be said in discussing means of attaining safety. Many of the circuit-opening devices that have been introduced in the past have been capable only of breaking certain definite currents, and incapable of coping with the conditinos existing when a very large system is short-circuited. Most of the switchboard devices that are now in use for alternating work are strictly limited in the range of their safe action, and would be valueless on a cirucit capable of delivering a large amount of power.

In the past, alternators have been generally used singly and in comparatively small units; the total power that could be delivered to one point being limited to the maximum output of one machine. In many of the installations now being made, numbers of large machines are being run in parallel, and the power that can be delivered at any point is consequently large, and the difficulty of breaking the current that flows in case of short-circuit is correspondingly great.

In the new station of the Metropolitan Railway Com-

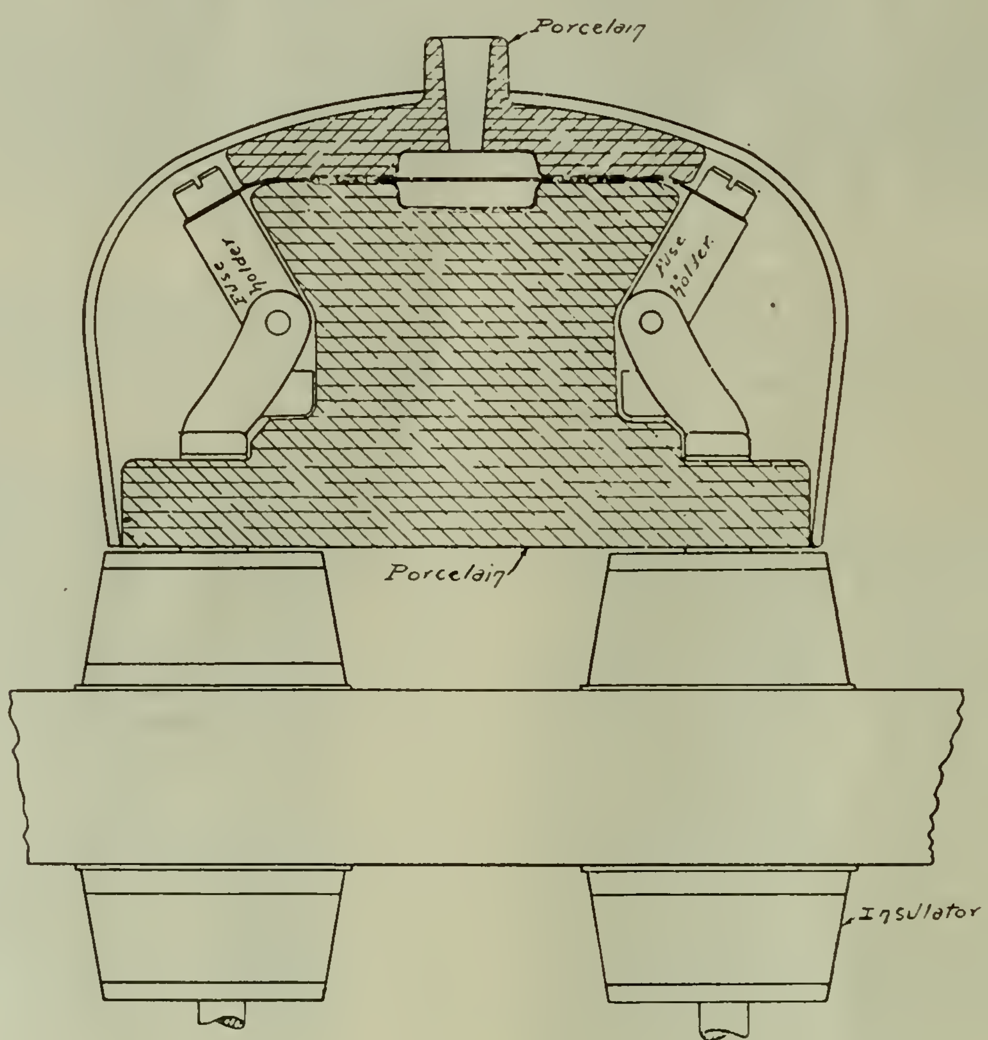


Fig. 7.

secondary mains in question.

One of the reasons why this subject has not come into prominence before, is that system of alternating secondary mains have not been much used till quite recently, and, consequently, the possibility of crosses between primary and secondary wiring in streets has not existed.

The rule of our underwriters which prohibits the grounding of secondary writing is not supported by the practice of other countries. I am informed that in England and on the continent, secondaries are very generally either grounded or protected by some such automatic devices as I have described. The prejudice against grounded circuits in buildings has always been very strong in this country, and in my opinion has been carried to unreasonable lengths. Grounded circuits of moderate potential can, with very simple precautions, be installed in buildings with perfect safety.

The third cause of danger in electrical distribution, which I have mentioned, is arcing through accidental opening of circuits or through failure of circuit-opening pany, about fifty thousand kilowatts will be delivered to a single set of 'bus-bars, and from there distributed all over the city. Wherever a sub-station or other installation is connected to these lines, means must be provided by which the circuit can be broken instantly in case a short circuit occurs. The power of this station is generated and distributed at 6,000 volts, and the loss in lines will be small, so that the violence of a short-circuit in a sub-station will be almost as great as if it were on the main 'bus-bars.

We have recently done a good deal of work on circuit-opening devices for such heavy duty. One of the principal troubles in such work is the difficulty of making experiments. We have a testing outfit at Mechanicville with which we can get from three hundred to four hundred amperes at 15,000 volts with an inductive load, and at Niagara Falls I have tested some devices with 700 amperes and 13,000 volts and a highly inductive load, the voltage rising to 18,000 when the circuit was opened. In comparison with past experiences these conditions seem

heavy, but they are light when compared with those which must be met in some plants that are now being installed.

There is, of course, a limit to the capacity of every circuit-opening device, and as power units become enlarged it will be necessary to provide means for limiting the total amount of power that can be delivered to individual branches. This object can be accomplished by inserting reactances in these branches; such reactances can be so proportioned that they do not materially interfere with the normal operating conditions, and, at the same time, they can so limit the total power delivered that it is kept within the safe range of the circuit-opening devices. Up to the present time, such reactances have not been much used. Their introduction naturally somewhat affects voltages, and for this reason may be considered undesirable. By judicious arrangement and proportioning, the objections can, to a great extent, be overcome, and there is little doubt that such devices will be much used in the future.

I have prepared sketches of a few circuit-opening devices that have resulted from recent investigations and experiments, and will briefly describe their design.

Figure 7 shows a fuse block in which the fuse is in a state of tension between two hinged terminals; these terminals are pulled part by springs and receive current through flexible connections. The fuse is punched out of sheet metal, the narrowest portion being at the middle. It is placed between two blocks of porcelain, a small amount of clearance being provided where the fuse passes through, so that its ends can be freely withdrawn by the movable terminals after the narrow part of the fuse has become ruptured. Around the narrow part of the fuse the porcelain blocks are recessed so as to provide an air chamber; this chamber is vented by a hole in the upper block. The whole device is firmly clamped together, so that the only opening to the outer air is through this one vent-hole. The fuse, being under tension, does not quite reaching the melting point before the break occurs. quite reach the melting point before the break occurs. apart. It is quickly withdrawn by the springs from the air chamber in which it has been broken. A very small amount of the metal is volatilized and its gas is blown out of the vent-hole. For the purpose of preventing any deposit of metal fumes on the porcelain surfaces, these surfaces are lined with muslin that has been treated with shellac or varnish and pressed into the desired shape. This lining covers the interior of the chamber in which the fuse is broken and the porcelain surfaces between which the fuse is drawn. These linings are supplied with the new fuses and are renewed if any appreciable amount of burning has occurred.

With a fuse of this type, occupying a space of six inches by three inches on a switchboard, I have repeatedly broken 300 amperes at 13,000 volts without the slightest injury to the device.

AMONG THE SOCIETIES.

NATIONAL ASSOCIATION OF MUNICPAL ELECTRICIANS.

Wilmington, Del., June 17, 1899.

Dear Sir:

I am pleased to state that all the space for the Wilmington, Delaware, Electrical Exhibition in connection with the Fourth Annual Convention of the "National Association of Municipal Electricians," has been taken and everything points to a most successful meeting. Delegates from all parts of the United States and Canada will be present, and over one hundred cities will be represented. The Board of Trade of the City of Wilmington have taken in hand the matter of entertaining members and guests of the association, and a most enjoyable time may be expected. The space assigned to your company is most excellently located, and I trust you will consider it wise to make a full line exhibit of your goods, which should be sent by express or freight, charges prepaid, addressed to Pyles Cycle Academy, Wilmington, Del. The academy will be at your disposal on and after August 28th. All exhibits must be in place not later than Monday noon, September 4th. as the exhibition opens at 7.30 P. M. that date. For any further information address H. B. Mason, Kings County Elec. Equipment Co., 340 Fulton street, Brooklyn, N. Y.

Yours respectfully, J. W. AYDON, President.

BUSINESS NEWS

SPECIAL EXPORT COLUMN.

TOTAL AMOUNT OF ELECTRICAL EXPORTS FOR WEEK ENDING JUNE 13, 1899, $33.514.00.

New York, N. Y., June 13, 1899.—The following exports of electrical material, etc., are from the port of New York for the week ending this date:—

Africa:—5 packages electrical material $788.

Argentine Republic:—2 cases electrical material $48.

British East Indies:—8 cases electrical material $48.

British West Indies:—43 packages electrical material $873.

Barcelona:—16 cases electrical material $250.

Brussels:—7 cases electrical material $400.

Brazil:—24 packages electrical material $1,718.

British Australia:—13 cases electrical machinery $398.

British Possessions in Africa:—105 packages electrical material $45. 2 crates electrical machinery $50.

Cairo:—4 packages electrical material $433.

Cuba:—22 packages electrical material $393.

Copenhagen:—3 packages electrical material $63.

Dublin:—1 package electrical material $26. 27 reels cable $10,568.

French West Indies:—1 case electrical material $13.

Glasgow:—3 cases electrical machinery $360.

Hull:—16 cases electrical material $1,748. 3 cases carriages $250. 63 packages electrical machinery $1,500.

Helsingfors:—1 case electrical material $18.

Hamburg:—92 packages electrical material $6,786.

Liverpool:—10 packages electrical material $394.

London:—17 cases electrical machinery $416. 43 packages electrical material $1,400.

Mexico:—67 cases electrical material $976.

Milan:—1 package electrical machinery $57.

New Zealand:—4 cases electrical material $80.

Porto Rico:—4 cases electrical material $165.

Rotterdam:—4 cases electrical machinery $65.

Southampton:—16 packages electrical material $2,635. 20 cases electrical machinery $320.

Venezuela:—11 packages electrical material $158.

Warsaw:—4 packages electrical material $72.

NEW INCORPORATIONS.

Mount Vernon, Tex.—The Mount Vernon Electric Light Co., will be organized with R. A. Day, President; J. H. Gordon, Vice-President, and T. B. Banister, secretary and treasurer.

Rogersville, Tenn.—The Rogersville Electric Light

Co., incorporated by C. C. Cochran, A. B. Rogan, S. Webster and others. Capital stock $5,000.

Jersey City, N. J.—Riker Electric Vehicle Co., incorporated by Andrew L. Riker, Wm. G. Meyer, James C. Young; manufacture electric vehicles, etc. Capital stock $7,000,000.

Hazleton, Pa.—Hazleton Electric Light & Power Co., incorporated by H. J. Ross, R. M. Hughes, A. A. Sterling, and others; supply light, heat and power. Capital stock $1,000.

Jersey City, N. J.—E. Howard Power & Clock Co., incorporated by Alfred Ely, Wm. H. Carey, and Edward A. Freshman; to carry on the business of an electric light company. Capital stock $1,000,000.

Sedalia, Mo.—Sedalia Electric & Heating Co., incorporated by J. G. Van Riper, A. M. Trader, J. Montgomery, Jr., and others; supply steam or hot water for Sedalia and other cities. Capital stock $100,000.

Tiffin, Ohio.—Tiffin Light & Fuel Co., incorporated by F. I. Isbell, C. H. Lemmon and others. Capital stock $50,000.

Portsmouth, Va.—The Portsmouth Electric & Gas Co., has been incorporated by J. T. King, C. O. Haines, R. E. Camp, and others. Capital stock $50,000.

San Francisco, Cal.—Tehama Electric Co., has been incorporated by J. Cross, C. F. Hanson, M. F. Michael, C. W. Willard, and A. H. Winn; to generate, produce and sell electric lights. Capital stock $50,000.

Portland, Me.—New Era Electric Protection Co., has been incorporated by James H. Clark, George H. Clark, George H. Mason, and Geo. D. Kemp. Capital stock $100,000.

TELEPHONE CALLS.

Yazoo City, Miss.—The Sunflower & Silver Creek Telephone Co., incorporated by George S. Irving, W. A. Campbell, F. W. Sharborough, J. W. Hoolfork and others. Capital stock $800.

Frankfort, Ky.—Carrollton Telephone Exchange Co., incorporated by R. M. Parker and others. Capital stock $5,000.

Fayette, Ohio.—Fayette Telephone Co., incorporated by A. J. Venier, F. W. Wood, G. H. Probst, and others; construct and maintain a telephone exchange. Capital stock $10,000.

Gatesville, Tex.—The Gatesville Telephone Co., incorporated by A. D. Honeycutt, W. L. Oldham, and K. E. Falker; to establish a long-distance telephone system between Gatesville and Hamilton. Capital stock $5,000.

Perth Amboy, N. J.—Amboy Telephone Co., incorporated by Andrew Dingler, Richard S. Bowen, and Samuel A. Boyd; to build and operate a telephone line. Capital stock $10,000.

STREET RAILWAY NEWS.

Columbus, Ohio.—Springfield, Columbus & Zanesville Electric Railway Co., has been incorporated by J. A. Mehling, A. T. Seymour and others; to build and operate an electric railway. Capital $10,000.

Romulus, Mich.—Washington I. Robinson, of Detroit, has been granted permission to build an electric railway through the township from Detroit to Toledo by way of Belleville.

Ashand , Pa.—The Ashland and Centralia Electric Railway Co., has been granted a charter to build a line between Ashland and Centralia. The company is capitalized at $50,000.

BROOKLYN, N. Y.—The railroad and property of the Prospect Park & Coney Island Railroad Company has been leased by the Brooklyn Heights Railroad Company, and possession was taken of midnight Saturday, June 17, 1899, Mr. Ira A. McCormack has been appointed general superintendent in charge of operation, and Mr. J. C. Brackenridge chief engineer in charge of maintenance of way, buildings and construction.

POSSIBLE INSTALLATIONS.

Wartrace, Tenn.—John E. Russell may be addressed concerning establishment of electric lighting plant.

Gastonia, N. C.—Mayor Lewis may be addressed concerning erection of electric light plant.

Dickson, Tenn.—W. T. Anderson is erecting a flour mill, and he will also erect an electric light plant in connection with same, sufficient for lighting the city.

Thomas, W. Va.—The Mayor may be addressed concerning erection of electric light plant.

JOTTINGS,

THE MONTAUK MULTIPHASE CABLE COMPANY will soon have ready for issuance, a revised price list. This has been made necessary owing to the recent advance in metals. All price lists heretofore issued are subject to this revision. A new book is being made ready for the press, and will soon be issued, giving data for specifications and plans of buildings showing the installation of the cables; also directions for installing. Copies of the same will be forwarded upon application.

THE ELECTRIC SUPPLY MEN'S ASSOCIATION held a meeting at their attorney's offices, Temple Court Building, New York City, on Wednesday morning, June 21st, which was deferred until the afternoon of the same day, due to the delay of the Philadelphia body which had met with an accident on the P. R. R., en route to New York. The association is raising the price of certain staples in order to meet the demands of manufacturers who have been working at a loss for some time. The standardizing of prices will be a boon to contractors as it will do away with ruinous competition and installations of all kinds.

COLUMBIA ELECTRIC SUPPLY COMPANY, of 93 Liberty street, 329 Fourth avenue, New York City, and Albany, N. Y., held a reception at their salesrooms, 93 Liberty street, on Wednesday, June 21st, to celebrate the opening of their new departure. Messrs. Meikleham and Douglass received their numerous friends; a large delegation from the Electrical Supply Dealers' Association being on hand. The Columbia Company are to be congratulated upon their fine supply store. The main offices of the company are in the rear of the store, while the front, about 60x25 feet, is stocked with everything in the suppply line. The two basements are stocked for large orders on immediate delivery. G. Stanmore, the old electrical maintenance and repair man, has charge of the repair and motor department. F. F. Hopper has charge of the lamp department. J. C. Moulton, so well known to large buyers in this city, has charge of the salesroom, and was busy Wednesday receiving his numerous friends and doing the honors for the business.

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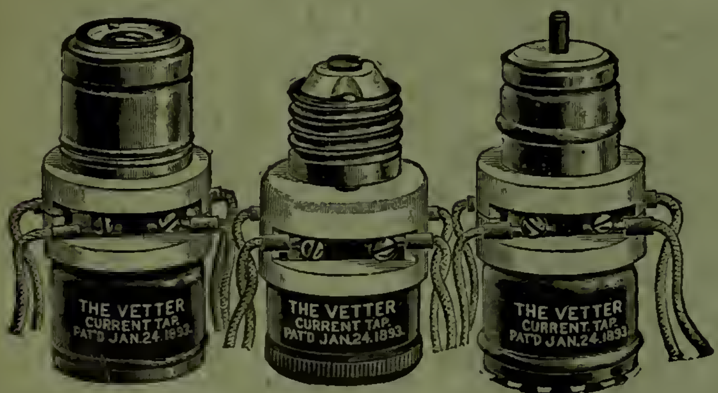

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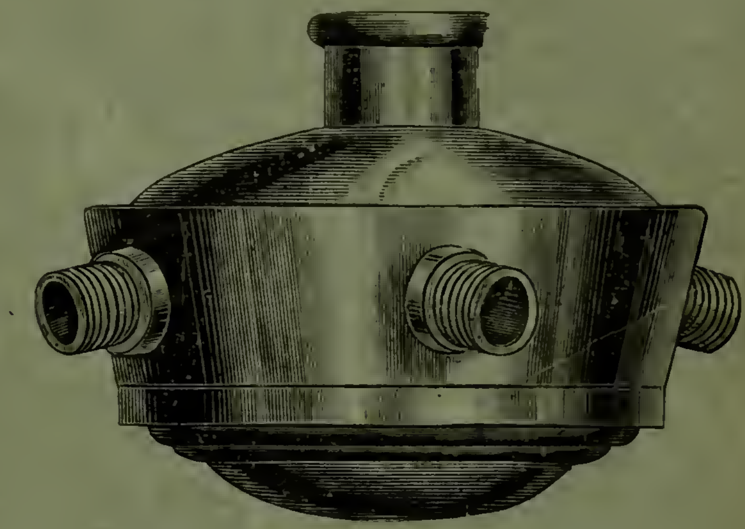

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